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CONTENTS

EDITORIALS 1
LETTERS TO THE EDITOR 4
NEW BOOKS 4
A TURNING POINT IN AMERICAN RAILROAD HISTORY 5
INCREASED LEVERAGE IN TRACK JACKS; W. B. TEMPLETON 9
WASHOUTS REQUIRE EMERGENCY MEASURES 11
INSURING SAFETY IN STEEL ERECTION; E. A. GIBBS 13
IMPROVING MAINTENANCE OF WAY METHODS; A. M. BURT 16
TIMBER PERFORATING PATENT GIVEN TO PUBLIC 17
A NEW NUT LOCK 18
OLD POP, THE DEPENDABLE; CHAS. H. SMITH 19
PREVENTING MOTOR CAR ACCIDENTS; J. L. WALSH 22
A CONCLUSIVE RECORD FOR CREOSOTED PILES 23
IMPROVING THE QUALITY OF STEEL RAILS; R. W. HUNT 25
THE TREATMENT OF WATER FOR LOCOMOTIVES; WM. M. BARR 27
PROTECTION OF WOODEN BRIDGES FROM FIRE 29
RULES FOR THE PREVENTION OF THE SPREAD OF FOREST AND FIELD FIRES 30
ACTIVITIES OF THE RAILROAD ADMINISTRATION 31
MOTOR TRUCKS IN RAILROAD SERVICE 33
MATERIAL MARKET 33
ASSOCIATION ACTIVITIES 34
GENERAL NEWS 35

Motor Trucks and Maintenance Work

Various expedients have been tried from time to time in efforts to reduce the amount of work train service in the maintenance of way department. Probably the greatest success has resulted from the plan of pooling, or combining, wherever possible, the work of the various branches—the roadway, the bridge and building, and so on—of the department so that a single train might be utilized by all. This plan is particularly successful in the distribution of supplies and materials. Motor cars also have been used successfully by the Lehigh Valley, the Richmond, Fredericksburg & Potomac and other roads in lieu of work trains in the distribution of materials and supplies and now, as is pointed out in another column in this issue, the Pennsylvania is using motor trucks for this work. While the primary purpose of these trucks in this service was to release work trains for the more important work of the department, the economies which have resulted are so important that their more extended use in suitable locations warrants serious consideration.

The Burden on the Maintenance Officers

One of the most important articles in this issue is the one on maintenance of way under the Railroad Administration which appears in a group of articles reviewing the past year and the two years of government control. While the data contained in this review are far from complete, the statistics on tie and rail renewals presented therein constitute the most definite figures that have been given out thus far, not only as regards the period of government control, but also as to any previous time. These figures taken by themselves are obviously not complete enough to enable one to form a definite conclusion as to the exact condition of the roads at the present time. Nevertheless, it is clear to one familiar with the subject that a considerable amount of deferred maintenance has accumulated since the roads were taken over by the Railroad Administration which, added to the deficiency in maintenance already accrued on January 1, 1918, leaves them in a weakened condition at the present time. To see this condition in its true light one must also bear in mind that there has been an increase in the average density of traffic of over 30 per cent in the four or five years during which this process of deterioration has taken place. The increases in rail failures now being noted in some places are but one index of this condition. The menace of the situation and the seriousness of the responsibility which it places on the maintenance officer are not to be considered lightly.

Better Records Are Necessary

The article by A. M. Burt in this issue calls attention to the need of more accurate measures of accomplishment in maintenance of way work—in other words, cost records that really mean something. The most common complaint heard among railway men is that too much of their time is already being taken to prepare and visé accounts. It is true that the records now required are much more voluminous than was the case in years gone by, but unfortunately they are of but limited value to the men responsible for

their preparation, while there is real need for cost records that can be put to some use in conducting the work. Compare the status of cost accounting on railroads with that of contractors or industrial concerns; the officers of most every successful business are fully advised at all times just what each item of the work is costing and within a few days or even a few hours after the work is done. There is a good reason for this. The cost accounts of contractors and manufacturers are kept for the purpose of affording a check on the cost of the work. Most railway records are prepared because the information is required by the Interstate Commerce Commission. That the preparation of cost records on maintenance of way work is fraught with obstacles is not to be denied. This was demonstrated beyond any doubt by the difficulties which the Railroad Administration officers encountered when they endeavored, late in 1918, to secure certain statistics on maintenance of way from the individual roads. But the point is this—*it must be done.* With the high cost of labor and materials, it will be necessary for the roads to conduct maintenance operations on a much more scientific basis than heretofore and the very foundation for improvement is a system of accounts that will show how and where the improvement must be made. Whether the advance is to be made through some form of bonus system, or through competition between units of the organization, the performance records are a necessary feature of the plan, whatever it is. Mr. Burt gives a significant warning—the danger that the initiative in instituting more complete maintenance of way accounts may be taken by accountants unfamiliar with the work, with the result that a more or less unworkable accounting structure will be set up. The answer is clear, the maintenance of way officers themselves must take up the problem. They are the ones to benefit by its solution and they are the only ones really competent to solve it.

START PLANNING NOW

THE PRESIDENT'S proclamation of December 24 definitely fixed March 1, 1920, as the date for the return of the roads to their owners. This action removes the uncertainty which has existed for some time and which has exerted an adverse effect on all departments of railway service. The President's action is especially timely from the standpoint of the maintenance of way department. Not only are the roads now able to undertake the preparation of their plans for the ensuing season's maintenance and improvement work, but the date selected for the return of the roads is in advance of the normal date for the inauguration of the work in most parts of the country. The officers of the maintenance of way department can, therefore, survey their requirements and lay their plans under conditions approximating the normal status in so far as freedom of control is concerned.

No time should be lost, therefore, in preparing and securing approval of detailed budgets in order that the requisite materials may be ordered, for, with a large number of roads coming into the market at once, manufacturers will have difficulty meeting all demands which will be made upon them, particularly when in many instances their production is being interfered with seriously by the general labor unrest. Not only should every effort be exerted to secure prompt delivery of materials, but plans should be made for the early inauguration of work. With a general resumption of activities and with the large amount of highway and other general construction work in prospect, the demand for labor will far exceed the supply and it will be necessary to extend the season's work over as long a period as possible if the necessary program is to be completed. Many roads were not adequately maintained during the three-year test period, while the general average standard of maintenance of all roads in the country was then below normal. That this test period standard has not been exceeded during the two succeeding years of government control is hardly open to question. As a matter of fact, it is generally agreed that even the test period standard of maintenance has not been kept up.

Every student of maintenance knows that the result of the continuance of such a practice cannot but be ultimate disaster. The roads are facing the necessity for extended rehabilitation. Much of this work must be done in 1920. The maintenance of way department cannot be found lacking because of inadequate preparation. Now is the time to begin.

CAN THE LABOR TURNOVER BE REDUCED?

THE YEAR WHICH has elapsed since the signing of the armistice has been marked by a general business revival. This has been cumulative and in the past few months builders, manufacturers and other concerns have been offered more business than could be handled. The policy adopted during the war to subordinate all other work to that essential to the winning of the war resulted in the deferring of a vast amount of improvement work. During the same period the available unskilled labor supply dwindled, owing to decreased immigration and various other causes. As a consequence, in many lines of endeavor we are now facing the necessity of meeting 1920 requirements with 1917 facilities and a depleted supply of labor. In the effort which it seems certain will be made to catch up with the situation competition for labor will be exceedingly keen, and one of the attributes of competition for labor is usually an increased turnover. This is not a new experience for the railroads, as is evidenced by the records kept by certain roads which show the number of men engaged to maintain certain forces. In 1917 one road found it necessary, over a period of six months, to recruit ten men for each job. Another road found itself breaking in a complete new force every 15 days. Even under normal conditions such a turnover constitutes a very serious problem and one which has been studied carefully by maintenance officers for years. Under present conditions its solution becomes vital.

There are many who believe that even with the present acknowledged depleted supply there are enough laborers in the country to carry out the vast amount of work which must be done in the coming months and years if the proper means of controlling and reducing the labor turnover be devised. Adequate compensation, of course, is the prime requisite for contented employees and a decreased turnover of labor, as are also good living and working conditions, the hours worked, and especially the continuity of employment. During the past few years wages have been advanced materially and the tendency of the roads to provide improved living and work conditions has been marked. During the same period there has been a reduction in the hours constituting a working day. While it is probably too early to judge finally the effect of the eight-hour plan, the present indications are that one result will be a reduced output per man per day without an appreciable reduction in the turnover unless permanent employment is granted as an added attraction. Men cannot afford to work on the railroads for a rate comparable to that paid by outside industries if it is morally certain that at the end of the working season they will be laid off. That the road will find itself without forces, where other employment which promises to be permanent may be readily secured in the neighborhood of the railroad, has been the general experience. In more

than one instance relief has been secured through the adoption of a permanent track force policy. Invariably this has resulted in getting the work done with less men and in an almost unbelievable reduction in turnover, the records of one road showing that after a three-year trial of this plan, 90 per cent of men originally engaged were still on the job.

A COURT FOR INDUSTRIAL RELATIONS

ONE OF THE marked developments of federal control has been the general recognition accorded labor organizations and the opportunity afforded for the extension of their activities to many branches of the service in which their success had been limited heretofore. Nowhere has the development been more marked than in the maintenance of way department. Now that the early relinquishment of federal control is definitely assured, much interest is being shown by officers and men alike in the effect this transition will have on this development.

Obviously, the relations between the managements and the employees must conform to any legislation enacted to control the roads under private operation. Here the two bills now before Congress differ radically. The Esch bill, which passed the House of Representatives, provides for the continuance of existing wages and working agreements and for the creation of a somewhat complicated means of adjusting future differences. The Cummins bill, which has passed the Senate, provides for a somewhat different board of adjustment and contains a definite ban on strikes. The labor organizations have shown strong opposition to the latter feature, some representatives asserting that if this provision is retained in the legislation finally enacted, they will defy the government by calling a strike at once. The reaction of Congress to this threat will be awaited with interest. It will without doubt be guided by the sentiment of the country as a whole in so far as this sentiment is made known to it.

There is no question but that the American public has grown weary of strikes. It has had a recent lesson in the coal strike of the manner in which the industrial life of the nation and the very existence of its hundred million people may be placed in jeopardy by a controversy between a group of less than a half million men and their employers. That the public will fail to learn a lesson from this experience is unbelievable; that it will not tolerate the continued threat of a strike which will threaten the interruption of its arteries of commerce on which life is even more directly dependable than on coal, is equally certain. Some provision is therefore needed to insure that differences of opinion between a few or many railway officers on one hand and their employees on the other hand, may not bring paralysis to the nation as a whole.

To prevent a group of workmen from wielding their most effective weapon—the strike—it is necessary that they be given a means of relief which will make the strike unnecessary. In civil affairs, the courts are the means of last resort. Controversies are settled there and there is no appeal from the final decision. It would seem possible to perfect a system of industrial courts which would hold the same confidence and the same power in industrial matters and whose decisions would be final on employer and employee. Such courts would necessarily be composed of men of marked ability and unquestioned honesty, selected for long terms. Surely if the Supreme Court can pass on the fate of an entire industry as it has done recently with the liquor business, a system of courts can be developed in which employer and employee alike can rest their cases, with the knowledge that they can receive justice.

The day of the individual in industry has passed and in its stead has come the period of large organizations of employees and employers. This demands new means of adjusting controversies. The arbitration board, the members of which are chosen by the parties to the controversy, has failed to satisfy the demand and to enforce its decisions. A non-partisan court, selected for ability and without reference to any particular controversy, whose findings would be binding on all parties, seems to be demanded by the times. Surely there is no industry more vital to the country or one in which it is more necessary to prevent strikes and lockouts than is transportation. The situation demands legislation of a positive, constructive character. The industrial court offers one means to this end.

THE LATEST INNOVATION IN MAINTENANCE

EFFECTIVE ON December 16 last, maintenance of way employees on all roads under federal control, including all the large roads of the United States, came under a uniform working agreement, which was made public just as the December issue of the *Railay Maintenance Engineer* went on the press and in which it appeared on page 435. This action is of primary importance to the maintenance of way department because it is certain to exert a marked influence on the conduct of the work in this branch of railway service for years to come. Local agreements have been in force previously on certain individual roads, particularly in the southeast and in New England. They have also been in effect for a number of years on certain roads in Canada. However, on most roads no general agreement of this character has ever before controlled the relations of the employees and the corporations. This agreement is, therefore, an innovation and a development of primary importance to the maintenance of way department. Coming so quickly after the general organization of the men in the gangs into the Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, it constitutes a new influence in the development of maintenance of way practices which must be reckoned with in the future.

The effect of this development, which has been brought about, or at least hastened greatly, by certain influences present in government control, will be watched with interest after the roads are returned to their owners. The document is signed by the Railroad Administration, acting for the roads, and its authority will end on the termination of federal control on March 1. The agreement further provides that it may be dissolved by either party on thirty days' notice. Whether steps will be taken to brings about the annulment of this agreement after the termination of federal control remains to be seen.

The advantages of this agreement to the men are obvious. In addition to securing for them the eight-hour day with time and one-half for overtime, it standardizes many working conditions. From the standpoint of the railways the cost of performing work is not only increased directly by the raise in the rates of pay, but also by the expenses arising from the administration of the terms of the agreement in detail.

This entire subject requires careful consideration and the exercise of mature judgment and broad vision on the part of the representatives of the employees as well as the employer. Little will be gained by either party in attempting to force matters, because of any temporary advantage which it may possess. From the standpoint of promoting efficiency in operation, all precedents in labor organizations are against any probability that this agreement will result to the benefit of the public in better or more economical service. This being the case, the organization is on trial to justify its existence for any other purpose than to promote the individual interests of its members.

LETTERS TO THE EDITOR

DO WOODPECKERS LIKE CREOSOTE?

Laurel, Miss.

TO THE EDITOR:

Much has been written and a great deal more has been said about the advantages of treating timber to prevent decay and delay the destructive action of marine borers. However, I have seen nothing on the relation of timber treatment to the destruction of wood by woodpeckers. We have a number of creosoted timber water tanks and also some lines of creosoted pine telegraph poles in northern Mississippi and Tennessee that have been seriously damaged by these pests, which have made holes through almost the entire thickness of the timbers. Until recently this was a rather unusual occurrence, but it now seems to be quite common. I do not know whether the woodpeckers eat the creosote or not, or what effect it would have on them if they did. At any rate they seem to be able to continue their operations without any difficulty. If any of your readers can offer suggestions as to means for combating these pests, I will be very glad to hear from them.

L. W. DUFFEE,
Chief Engineer, Gulf, Mobile & Northern.

COST PLUS WHAT?

Philadelphia, Pa.

TO THE EDITOR:

It is likely that maintenance by contract on the cost plus basis is gone never to return. In view of what is known, he would indeed be a rash operating officer, who, in the absence of a compelling emergency, should seek to restore that method of wasting the company's money. The disclosures which follow are given with no expectation that the practices mentioned will be abandoned voluntarily; for the inquiry is pertinent in this connection, "can the leopard change his spots?" These are the times when the analysis of past accomplishment will be made, when unit costs of work will be figured; so many yards of grading cost so much money; the renewal of a tie costs how much and what was spent for the maintenance that did not maintain?

The entire scheme of maintenance by contract depended almost wholly upon the integrity of the contractor. It was beyond the control of the contractor's superintendent, for in most cases he had no jurisdiction at all over the office accounts. The fact is well recognized, and it has been clearly and forcibly stated in a recent communication appearing in these columns, that a deliberate policy of slacking was followed in many places. The poorest labor was equally acceptable with the best, on the principle that the greater the inefficiency of the men, the longer the necessity would persist for labor being furnished. For a similar reason a minimum performance was required, with the exception, of course, of such times as the company's inspector was known to be about. This last feature more than any other explains the low state of morale found generally among the labor forces today. In some instances even tools were withheld in order that men might have a better excuse for loafing. It was of chief importance that they should hop to the job in time to be checked. The keynote of many an operation was "not to work the contractor out of his job."

Besides the policy of slacking, which truly was bad enough, there was in several known instances actual dishonesty in rendering an account of the labor. Probably the most common offense in this respect was charging for the employee's service a higher rate of wages than he received on the contractor's payroll. One example may be cited by way of illustration, in which foremen who were paid 35 cents per hour were charged against the force account at the astonishing differential of 60 cents per hour. One result of the exposure of this practice was to make the contractor more careful for the future

Contractors of a certain class did not hesitate to attach to their own tills a portion of the wages collected in the name of their field superintendents. These very men were the source of the entire profit on many a job, in which the contractor merely signed the contract and paid the weekly wages, the superintendent and the foremen he selected recruiting the whole of the labor force. The manner in which the work was organized, by which men could see results without waste of effort, was always a main incentive in holding them. It is not true, as is generally supposed, that an easygoing method is effective in retaining laborers; at least it does not apply in the case of the better class of labor.

The reprehensible feature of these dishonest practices is especially that they were not always known to the field superintendents until long after the results obtained had been brought into question and their performance in some cases discredited. Such a policy in the case of a man with honest principles was like a stab in the back. He was not in a position to defend his accomplishment; his reputation was stolen along with the dollars of the railroad. It is essential for these reasons that unit costs of maintenance work under the cost plus plan should be considered carefully in the light of what opportunity for profit there may have been. In some places, through watchfulness of the inspector, the chance for fraud was entirely lacking; in others it is feared that the graft may have been shared by the officer whose duty it was to check the account. No apology for this recital is necessary to those contractors of proven integrity, and they are doubtless in the large majority, who gave full return for the profit received; but to those few profiteers in the country's emergency will belong the condemnation which they so justly deserve.

W. F. RENCH.

NEW BOOKS

Proceedings of the American Railway Engineering Association, 1011 pages, illustrated, 6 in. by 9 in. Bound in cloth. Published by the American Railway Engineering Association, Chicago.

This volume contains the proceedings of the twentieth annual convention of the American Railway Engineering Assoociation, held at the Congress Hotel, Chicago, on March 18, 19 and 20, 1919. The 23 reports of the committees cover 740 pages, the largest being the report on rail which contains considerable data and information relative to rail failures from transverse fissures as found in actual practice. Results of the tests of splice bars made at the Altoona Laboratory are also given. Among other matters of special interest are studies of the unified operation of terminals and the ticket selling problem; the effect of signaling and the proper location of passing sidings on the capacity of single and double track lines; typical plans for housing labor, labor-saving devices and relationship of unit of track expenditure and unit per mile of line for different classes of roads. Three monographs are included, "A Study of the Mechanics of Curve Resistance," by John G. Sullivan, consulting engineer, Canadian Pacific; "Practice in the Design of Concrete Floor Slabs and Flat Top Culverts," by George H. Tinker, bridge engineer, New York, Chicago & St. Louis, and "Service Tests of Cross Ties," by P. R. Hicks, engineer in forest products, Forest Products Laboratory, Madison, Wis.

A Turning Point in American Railroad History

A Review of the Past Year and of the Period of Goverment Control. What Will the Future Bring?

ANOTHER YEAR of railroad history has passed and in two months the period of government management will have come to an end. Legislation now being whipped into shape at Washington promises an entirely new future for our transportation systems. No more important turning point has ever taken place in the eventful record of our railroads. Sensing the significance of this epoch-making hour, the Railway Age for January 2, 1919 (which appears simultaneous with this issue of the *Railway Maintenance Engineer*), presents some noteworthy facts concerning this important occasion. In addition to the presentation of a record of the progress in construction and equipment, etc., made during the past year, there is included a review of the period of government control. But the special feature of the issue from which is derived the name "Six Billion Dollar" issue, is a carefully prepared study of the present inadequacy of the railroad plant from which has been deduced the fact that $6,000,000,000 ought to be spent on the roads in the next three years if they are to serve as an impetus rather than a retardant to American commercial and industrial progress. In view of the interest which these subjects must bring to all railway men, we present an abstract of a number of the features of this issue below.

DEVELOPMENTS OF THE PAST YEAR

Under another head we present a review of the additions and betterments work done during the government control period, a subject that is closely related to the study of the needs for a general enlargement of railway facilities. Further light on this subject is given by the following statements of progress in the railway field during the past year. There is also a short statement on the progress of valuation work.

New Lines Constructed and Lines Abandoned

During 1919 a total of 686 miles of new railway lines in the United States and 433 miles in Canada were constructed and placed in service. This is a new low record for the United States since the 1919 mileage is less by 35 miles than the previous low mark of any year since the Civil War. Most of the new mileage in the United States during 1919 was in comparatively short sections. A total of 121.6 miles in Oklahoma is the largest increase for any single state. Texas was second with 86 miles and California third with 69 miles. In second track construction, the total in the United States was 405.32 as compared with 681 miles in 1918. South Carolina had a larger mileage than any other state. The total of 86.35 miles built in that state, and 41 miles completed in North Carolina were entirely the work of one railway, the Southern. The new third main track in this country was 27.54 miles and the fourth or more tracks 16.84 miles. Canada reports 9.15 miles of new second track.

During 1919 operation was discontinued on 637 miles of line in the United States which, it will be noted, is only slightly less than the mileage of new lines built during the year. This is the third year in which there has been this close relation between lines built and lines abandoned on American railways. In the years 1917 to 1919, exclusive, the total lines abandoned for operation aggregated 3,319 miles as compared to a total mileage in new extensions and branches of 2,386. Of the mileage abandoned this year 361 miles has been dismantled and petitions have been made to state authorities for permission to scrap a considerable portion of the remaining total. In considering causes for the abandonment of these railways, attention is drawn to the fact that whereas much of the mileage on which operation was discontinued in 1918 was accounted for by the pooling of facilities under the Railroad Administration, the abandonment of lines during the past year was the result of an inability to pay operating expenses under existing transportation rates.

The Record in Equipment

In the field of equipment, the output of freight cars by the American manufacturers in 1919 was 100,416 for domestic orders and 62,566 for export, or a total of 162,982. This total is much in excess of that for last year and has been exceeded only twice since 1907. The number of passenger cars produced last year in this country was 292.

During 1919, in the United States, orders were placed for 22,019 freight cars, 292 passenger cars and 214 locomotives. Canadian roads ordered 311 freight cars, 207 passenger cars and 51 locomotives.

In the Signal Field

Some progress has been made during the year in the extension of automatic block signals. The mileage of automatic block signals placed in service during the past year was 1,881 miles in the United States and 47 miles in Canada. The total of these two, 1,918, is nearly the same as the record for 1918. In the case of manual block signals there was an addition of 144 miles in the United States and no addition in Canada. The mileage of automatic block signals under construction but not completed during 1919 was 274 miles in the United States and no miles in Canada. In the field of interlocking plants, the new construction in the United States during 1919 totaled 153 plants with four new plants in Canada.

Valuation Work

According to recent reports issued by the Interstate Commerce Commission, Division of Valuation, the division is expected to complete all engineering and accounting reports for the Interstate Commerce Commission by December 31, 1921. The field work has nearly all been completed and a large part of the field forces have been disbanded. Engineering reports have been finished on 75,000 miles of road and it is expected that another 75,000 miles will be finished next year and the remainder in 1920. The Division of Valuation has served tentative valuations on 55 properties up to the present and in addition has submitted preliminary engineering reports on the properties of about 50 other lines.

CAPITAL EXPENDITURES BY THE RAILROAD ADMINISTRATION

Expenditures for additions and betterments under the direction of the Railroad Administration during the period of government control up to September 30, 1919, aggregated $1,061,621,366. This total is sub-divided as follows: Additions and betterments to fixed properties, $448,040,911; the construction of extensions, branches and other new lines, $25,928,064; cars, locomotives and other equipment ordered by the railroad previous to the advent of government control, $247,559,705; the U. S. standard cars and locomotives, $330,092,676. This amount is only a little more than two-thirds of the capital expenditures authorized during the period of government control, which amounted to $1,442,557,755. In the case of additions and betterments to the fixed property, the total authorized was $676,684,763, which was later reduced to $579,684,380.

The authorization of additions and betterments, extensions, branches and new lines was administered under the direction of the Division of Capital Expenditure. The director of this division from the time it was created in March, 1918, until January, 1919, was Judge R. S. Lovett, chairman of the board of the Union Pacific, his two principal assistants being E. E. Adams, consulting engineer, and S. W. Sercombe, assistant controller, of the Union Pacific system. Mr. Lovett resigned in January, 1919, and was succeeded by T. C. Powell.

The nature of the work authorized to be carried on under the direction of the Division of Capital Expenditures is shown in the accompanying table. This includes a large amount of work that was under way at the beginning of 1918 and which was continued during the period of federal control. Some of it was carried to completion and other projects were discontinued after the work had been carried to a point where it could be stopped without causing any considerable loss to the railroads. The work done during the period of government control was primarily of an emergency nature, involving the completion of such improvements as would afford an increase

AUTHORIZATIONS AND EXPENDITURES IN CONNECTION WITH WORK CHARGEABLE TO CAPITAL ACCOUNT FROM JANUARY 1, 1918, TO SEPTEMBER 30, 1919, INCLUSIVE, FOR CLASS I RAILROADS BY CLASSES OF WORK

CLASS OF WORK	ESTIMATED COST OF WORK AUTHORIZED			Deduct		EXPENDITURES		
	During Year 1918	From January 1 to September 30, 1919	Total January 1, 1918, to September 30, 1919	Unexpended Balances as of June 30, '19, for Work Completed or Deferred	Estimated Cost of Work Authorized in Effect Sept. 30, 1919	During Year 1918	From January 1, to September 30, 1919	Total January 1, 1918, to September 30, 1919
ADDITIONS AND BETTERMENTS (EXISTING LINES)								
1. Widening cuts and fills, filling trestles, etc.	$ 7,570,485	$ 3,947,447	$11,517,932	$ 1,636,098	$ 9,881,834	$ 4,190,363	$ 3,652,417	$ 7,842,780
2. Ballasting	10,115,591	4,391,551	14,507,142	3,300,465	11,206,677	4,416,469	4,036,620	8,453,089
3. Rails and other track material	34,645,402	23,357,669	58,003,071	3,586,447	54,416,624	15,195,237	19,897,521	35,092,758
4. Bridges, trestles and culverts	42,635,698	17,132,072	59,767,770	8,456,628	51,311,142	24,089,064	13,316,133	37,405,197
5. Tunnel and subway improvements	2,397,464	700,130	3,097,594	521,608	2,575,986	1,235,919	662,043	1,897,962
6. Track elevations or depressions	16,676,019	1,615,640	18,291,659	5,063,048	13,228,611	3,827,664	1,248,659	5,076,323
7. Elimination of grade crossings	12,053,906	3,787,558	15,841,464	2,028,400	13,813,064	4,361,286	2,665,448	7,026,734
8. Grade crossings and crossing signals	1,628,699	849,307	2,478,006	202,673	2,275,333	927,494	752,696	1,680,190
9. Additional main tracks	58,526,436	12,297,277	70,823,713	14,056,444	56,767,269	31,813,135	13,979,075	45,792,210
10. Additional yard tracks, sidings and industry tracks	122,612,008	20,759,767	143,371,775	26,202,756	117,169,019	61,296,503	30,551,448	91,847,951
11. Changes of grade or alignment	8,113,529	1,305,881	9,419,410	3,042,141	6,377,269	3,615,805	2,319,094	5,934,899
12. Signals and interlocking plants	14,558,065	2,165,973	16,724,038	2,227,827	14,496,211	6,689,059	5,439,952	12,129,011
13. Telegraph and telephone lines	5,769,432	1,174,747	6,944,179	679,885	6,264,294	3,048,278	2,124,808	5,173,086
14. Roadway machinery and tools	2,148,946	566,173	2,715,119	145,469	2,569,650	1,263,365	1,046,000	2,309,365
15. Section houses and other roadway buildings	3,252,771	1,375,716	4,628,487	610,048	4,018,439	1,987,967	1,440,508	3,428,475
16. Fences and snowsheds—Right-of-way, snow or sand fences	1,874,724	777,381	2,652,105	281,480	2,370,625	953,866	634,998	1,588,864
17. Freight and passenger stations, office buildings and other station facilities	32,256,325	10,341,351	42,597,676	5,087,670	37,510,006	18,190,190	9,572,246	27,762,436
18. Hotels and restaurants	951,822	335,866	1,287,688	123,714	1,163,974	555,869	440,058	995,927
19. Fuel stations and appurtenances	7,962,965	2,716,480	10,679,445	753,388	9,926,057	4,402,086	3,783,908	8,185,994
20. Water stations and appurtenances	12,772,851	3,532,329	16,305,180	1,649,498	14,655,682	6,725,874	4,701,423	11,427,297
21. Shop buildings, engine houses and appurtenances	56,325,588	22,702,320	79,027,908	6,651,471	72,376,437	33,742,428	37,317,925	71,060,353
22. Shop machinery and tools	21,887,005	6,352,070	28,239,075	3,395,153	24,843,922	8,187,677	10,075,106	18,262,783
23. Electric power plants, substations, transmission and distribution lines	18,472,736	4,298,328	22,771,064	1,084,364	21,686,700	7,313,101	7,606,491	14,919,592
24. Wharves and docks	5,652,741	1,531,497	7,184,238	2,441,019	4,743,219	1,690,622	2,014,510	3,705,132
25. Coal and ore wharves	5,816,271	908,631	6,724,902	561,069	6,163,833	4,654,628	685,028	5,339,656
26. Grain elevators and storage warehouses	2,928,970	1,711,629	4,640,599	881,845	3,758,754	1,728,891	1,582,107	3,310,998
27. Real estate	665,965	127,676	793,641	57,627	736,014	351,904	115,193	467,097
28. Assessments for public improvements	2,274,103	1,133,889	3,407,992	266,486	3,141,506	1,395,049	1,003,949	2,398,998
34. All other improvements	10,138,562	2,103,329	12,241,891	2,005,662	10,236,229	5,340,564	2,185,190	7,525,754
Total (excluding equipment)	$522,685,079	$153,999,684	$676,684,763	$97,000,383	$579,684,380	$263,190,357	$184,850,554	$448,040,911
OTHER CAPITAL EXPENDITURES								
44. Construction of extensions, branches and other new lines	$43,007,435	$ 4,569,138	$47,576,573	$11,048,254	$36,528,319	$17,942,615	$7,985,449	$25,928,064

in the traffic-carrying capacity of a railroad with the least delay. To a large extent the nature of the work undertaken was of the character demonstrated to be necessary by the experiences of the winter of 1917 and 1918. To this end a large amount of engine terminal work was done. Other important subdivisions were side tracks and yard tracks, additional main tracks, coaling stations, repair shops, shop tools, etc.

Like all other undertakings involving the use of men and materials during the war period, it was physically impossible to obtain the desired progress on the projects for increased facilities to the degree that would effectively ameliorate the railway congestion. As given on the table, the expenditures for additions and betterments chargeable to capital account (exclusive of equipment) authorized up to January 1, 1919, was $522,685,079, but of this total only about one-half, namely, $263,190,357, was spent during that calendar year. As a consequence of the financial difficulties of the Railroad Administration during the first half of 1918 and the reluctance of the corporate managements of the railroads to undertake extensive improvement work until the status of the railroads was definitely established, little new work was authorized during 1919 and a considerable volume of deductions was made from the budgets already authorized. However, owing to a considerable hold-over in the work authorized in 1918, a large amount of construction work was actually done during the second year of government management. The grand total of such authorization chargeable to capital account was $676,684,763 on September 30, 1919. This was reduced by deductions for unexpended portions of work completed or deferred to $579,684,380. The total expenditure from January 1, 1918, to September 30, 1919, was $448,040,911.

While the progress made on the improvement work of the Railroad Administration was not as rapid as it should have been to obtain the desired results during the first year, the performance was probably as good as could be humanly expected under the obstacles encountered as a consequence of war conditions. As it happened, the signing of the armistice and the mild winter of 1918 and 1919 served to moderate the demands made upon the railway property.

MAINTENANCE OF WAY UNDER GOVERMENT CONTROL

With the end of government control definitely fixed it is of interest to review the policies of the Railroad Administration with respect to maintenance of way. In such a survey one notes a distinct contrast in the manner in which this and other branches of railway operation have been administered in the two years of government control. Owing to the fact that the Administration made no arrangement for a centralized head for this department until late in 1918, maintenance work that year was carried on without much definite direction from either the central or regional organizations. During 1919, however, rigid control was exercised over maintenance matters. The first real step towards the organization of a maintenance department occurred late in August, 1918, when C. A. Morse, chief engineer of the Chicago, Rock Island & Pacific, was appointed assistant director of the Division of Operation in charge of engineering and maintenance of way. Mr. Morse built up no large central organization, but conducted the affairs of the department through the agency of the engineering assistants to the regional directors, most of whom were appointed about the same time.

A large part of the activities of the newly formed organization during the remaining months of 1918 was devoted to the gathering of data on maintenance of way work performed by the railroads during the government control period up to that time and for the three-year test period and preceding years.

Various circulars and other communications were addressed to the railway maintenance officers late in 1918 and in the early months of 1919, but no real issue with regard to maintenance of way took place until May 27, when Director-General Hines publicly stated that the Railroad Administration was up to its contract obligation on maintenance and issued orders tending to prevent excessive expenditure by requiring that the expenditures for the month of June should bear the same ratio to the operating revenues as was the yearly average for the test period. This was followed later by specific authority for somewhat curtailed expenditures for the second half of 1919. The most unfortunate feature of these rulings was that they came so late in the season. If the curtailment could have been arranged before the maintenance work was so far along, there is no question but that it would have done considerable less harm.

A decidedly involved controversy has arisen between the officers of the Railroad Administration and those of the railroad companies with regard to the adequacy of maintenance and it is conceded that no suitable plan has been devised for the determination of the adequacy of maintenance or a comparison of the present condition of maintenance with that at the time that the roads were taken over by the government. Consequently, it is impossible to make any definite statement in regard to the average condition of the roads at the present time.

Expenditures for maintenance of way during the period of federal control have been very much larger than those for any other corresponding period. In 1918 Class I roads spent $649,595,710 for maintenance of way, as compared to $442,109,862 and $421,775,812 for the calendar years of 1917 and 1916, respectively. For the first nine months of 1919 the outlay for maintenance on Class I roads was $575,122,124, as compared with $459,627,192 for the corresponding months of 1918 and $311,096,000 as the average for the first nine months of the test years. Expressed in percentages, the 1919 expenditures were 25 per cent and 85 per cent greater, respectively, than those for the corresponding period of 1918 and the average test period. These enormous differences are accountable primarily by the large advances in wages and increased cost of material. Efforts have been made to develop factors that would take care of these increases in cost, but officers of the railway companies contend that such factors should make an allowance for the decreased efficiency of labor.

RAIL RENEWALS

The situation as to rails is summarized in the following table:

Rails on order January 1, 1918	2,333,190 tons
Rails in stock January 1, 1918	462,529 tons
Rails delivered in 1918	1,212,618 tons
Rails laid during 1918	1,111,638 tons
Rails in stock at the beginning of 1919	563,509 tons
Rails on order undelivered on January 1, 1919	1,120,491 tons
Rails ordered by the Railroad Administration, 1919	241,000 tons
Rails delivered in 1919	1,161,491 tons
Rails laid in 1919 (estimate)	1,350,000 tons
Rails in stock at beginning of 1920 (estimate)	375,000 tons
Rails on order undelivered January 1, 1920	200,000 tons

The figures given in the above table for rail renewals during the past two years should be compared with the figures in the following table giving the record of rails laid in maintenance during the past 10 years:

Average new rail laid for maintenance in 7-year period	1,405,857 tons
Average new rail laid for maintenance in 10-year period	1,377,564 tons
Average new rail laid for maintenance in 3-year test period	1,328,316 tons

Assuming that the figures for rail renewals in the seven-year period constituting the most representative condition, the average deficiency for the test period is 1,405,859 tons minus 1,328,316 tons, or 77,543 tons, which amounts to 232,629 tons for the three years. A similar computation gives a deficiency of 294,221 tons for 1918 and 55,859 tons for 1919, or a total of 350,080 tons for the two years of federal management, not including the decrease of 87,500 tons in stock. If we are to assume that the tons of new rail laid in the second half of 1917 (i. e., the no man's land between the test period and the period of federal control) is one-half of the annual average for the test period, then the total deficiency in rail renewals at the present time is 232,629 tons plus 38,771 tons, plus 350,080 tons, or 621,480 tons.

THE TIE SITUATION

The production of ties in 1918 for use on the roads under government control, according to figures issued by the Forest Products Section, was considerably less than the normal production, the total being 65,499,720 ties, based on totals complete to November 1, 1919. The estimated production of ties for the second year of government control is 94,775,000 ties. The stock on hand at the beginning of government control was 44,420,691 and this stock was reduced by the end of that year to 36,556,400 ties, but owing to the increased production of 1919, it is estimated that the supply on hand at the end of this year will be something over 50,000,000. In the case of treated ties, the number subjected to preservation in 1919 is estimated at 55,000,000, while the number of ties on hand awaiting treatment on November 1 was 21,805,220.

In the matter of insertions in track the following table shows the renewals for 1918 and the estimated renewals for 1919 in comparison with those of the three test years and the averages for the 10-year period:

RECORD OF TIES INSERTED ON ROADS UNDER FEDERAL MANAGEMENT

10-year average		92,293,395*
Test period average		94,835,443
1915	Year ending June 30	101,931,879
1916		98,211,454
1917		84,610,248
1918		86,400,021
1919 (To Nov. 1, 76,580,185)		85,000,000 (Est. for yr.)

*The total "average test period" includes 84 small roads with 6,847 miles and 1,625,896 ties, which roads do not enter into the total "average ten years" because of incomplete reports.

With the average for the test period as the basis for comparison, this would indicate a deficiency in tie renewals during the two years of government control of about 18,000,000 ties to be adjusted on the basis of a comparison between the stock of ties on hand at the beginning and the end of government control. However, this deficiency does not express the full extent to which tie renewals are in arrears, for by examining the table it will be noted that the renewals for the last years of the test period were very low, and furthermore no account is taken of the six months from June 30, 1917, to January 1, 1918, during which time the renewals presumably were not made at a greater rate than during the preceding year.

The labor situation which has been frequently discussed in these columns is far from satisfactory. During the government control period the men have become fully organized and, while this condition is perhaps not primarily responsible, there is no denying that the efficiency of the average gang is not what it should be. With the return of the roads to private control, with a considerable accrued deficiency of maintenance, labor will offer one of the most formidable of problems to be solved before the properties can be restored to normal conditions.

OUR RAILWAY FACILITIES MUST BE ENLARGED

The railroads are to be returned to their owners on March 1 under a new status brought about by legislation to be agreed upon between the Senate and the House of Representatives before that time. If the roads are to serve properly the purpose for which they are intended, namely, to afford adequate facilities for transportation in proportion to the growth of American business, we are about to enter a period of pronounced additions to the railway plant, for it is well known that the present facilities are inadequate for the business now offered them. With a view to determining as near as possible just what the needs of the railroads are with respect to increased facilities, this subject was investigated with the result that a detailed estimate of the deficiencies has been made which shows that an additional investment of about six billion dollars should be made in the next three years if the railroads are to fulfill their function properly. The following discussion shows briefly how this six billion must be spent to secure the desired results:

Of first consideration in the popular mind would be the extensive development—that is, the construction of new lines or the extension of existing ones. With the spread of a network of railways over the country, there has been a marked reduction in the number of miles of new lines built from year to year since about 1900. To a certain extent this is normal, since this country will eventually attain the position of certain countries of Europe, where there is no occasion for the construction of extensive new mileages. However, this country has by no means reached that condition and there is no question but that the sudden decrease in new mileage since 1915 is abnormal. Only 3,500 miles of new line has been built in the United States in this time, which total is equal to only about one year's construction of the period from 1905 to 1915. From a study of these figures and a careful analysis of those portions of the country not adequately supplied with railway facilities, it is concluded that 6,000 miles of additional main lines should be built within the next three years to bring the mileage of the railroads into normal relationship with the commercial and industrial needs of the country. Considering the enormous increase in construction cost in the last three years, this additional mileage would unquestionably represent an investment in the neighborhood of $500,000,000.

The matter of second consideration is the intensive development of the fixed properties, namely, the necessity for increased facilities of existing lines in order that they may take care of the increased density of traffic, provide opportunity for greater economy of operation, replace obsolete facilities and meet the demands of the public for more elaborate facilities in the way of passenger stations, grade separations, etc.

The most important subdivision under this head is that of supplementary tracks, in other words, additional main, side and yard tracks. Exactly as there has been a deficiency in the construction of new lines as the country has grown, so there has been a failure to provide supplementary tracks in proportion to the increase in traffic density. Thus, while the increase in the density of traffic the country over was just as great in the 4½ years ending December 31, 1918, as in the 10 years ending June 30, 1914, the increase in the mileage of multiple main track was only 3,425 miles in the 4½-year period, as compared with 14,038 miles in the 10-year period, while the increase in siding and yard tracks in the same periods was 9,667 miles and 31,793 miles, respectively. From a careful analysis of these figures and a study of the nature of the improvements made in the past few years and

those required in the immediate future, it is concluded that 15,000 miles represents a fair estimate of the amount of second, third, fourth or multiple main tracks required and 30,000 miles is the amount of additional trackage in sidings and yards which should be undertaken within the next three years. Estimating $40,000 for additional main tracks and $18,000 for side tracks, it is found that these additional mileages would entail an expenditure of about $1,250,000,000.

Similar studies have been made of the need for reconstruction for reduction of grades and curvatures and it is concluded that reconstruction could well be undertaken on ½ per cent of the mileage of the country each year, which, taking into account the inadequacy of the past few years, would entail an expenditure of $600,000,000 in the next three years.

While a large amount of work was done on engine terminals, shops and shop tools during the last two years under the auspices of the Railroad Administration, it has been impossible to take up all of the deficiencies in such facilities. In fact, a very large part of the work done has been concentrated in the east where the need was most emergent, so that the expenditures by the Railroad Administration of $50,000,000 for each of the two years represents only about the normal requirements. Taking into account a deficiency of about two years, the expenditures within the next three years should aggregate about $250,000,000.

Passenger station work both large and small has been practically at a standstill for the last few years and less than a normal amount of work was done during two or more years previous. Making proper allowance for the normal requirements and the enormous demands which will be made upon the railroads as soon as they have been freed from government control, it is believed that $300,000,000 is a conservative estimate of the expenditures in 1920 to 1922, inclusive.

Turning now to the question of equipment, the shortage of which is apparent from the prevailing deficiency of cars. This need of equipment is especially severe in the case of freight cars, of which it is estimated that 712,000 should be built in the years 1920 to 1922, inclusive. At an average cost of $3,000 per car this would give a total of over $2,000,000,000. In the case of passenger cars it is estimated that 24,500 new cars are needed in the same period, which at the cost of $24,000 per car would represent an expenditure of $600,000,000. There is also a shortage of locomotives now estimated at 13,800, and at a cost of $66,000 this represents an expenditure of $911,000,000 in the next three years.

In a similar manner a study has been made of signaling, which, taking into account the current requirements and deficiencies in recent years, indicates that 8,820 miles of automatic block signal installation should be made each year for the next three years. At a cost of $3,800 per mile this represents an expenditure of $43,548,000. In the case of interlocking it is anticipated that the three-year requirements represent $9,216,000, so that the total expenditure for signaling in the next three years would be about $53,000,000.

Increased Leverage in Track Jacks

BY WALTER B. TEMPLETON
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THE ADVANTAGES of a square lever socket for track jacks, from the viewpoint of safety, economy and convenience, were set forth in a previous article. The increased leverage gained is one of the advantages of utilizing a square socket, designed to accommodate a lining bar or other track tool. A wooden lever averages 48 in. in length and a lining bar 66 in.; thus we increase the leverage 37½ per cent. Therefore, a section man is enabled to raise a 37½ per cent greater load, or he can raise it 37½ per cent easier. A lining bar will not crack, splinter or break under the heavy service demanded, whereas often the initial cost of a track jack is exceeded by the replacement values of wood lever poles.

Now, since the weight necessary to raise a given load is determined by the length of the lever, it takes 37½ per cent less weight at the end of the lining bar than at the end of a wooden lever to raise the same load. In other words, a man weighing 148 lb. can lift with a lining bar lever the same jack load that requires the weight of a 204-lb. man on the wooden lever.

This naturally suggests the question of whether a greater leverage in track jacks is necessary. The answer lies in a comparison of railroad conditions of 25 years ago with those existing today. Standard rail weight has increased from 60 lb. per yard to 100 lb. or more per yard; 7 in. by 9 in. by 9 ft. ties on some roads replace 6 in. by 8 in. by 8 ft. ties. Formerly ties were spaced 15 or less to a 30-ft. rail—now 19 or more are often used to a 33-ft. rail; stone and gravel are now generally used as main line ballast instead of the lighter cinders and dirt that was standard ballast in the past. Thus the weight of rail has increased 66⅔ per cent; the weight of ties (on some roads) approximately 48 per cent, while about 14 per cent more ties are used. Further, the ties are imbedded more securely in the stone or gravel ballast, adding greater resistance to a jack load.

There is one more weight factor that should be taken into consideration. The greatly increased stiffness of the heavier rail adds to the length of track raised ahead of the jack. Probably a quarter of a rail length more is now raised than formerly, or approximately 25 per cent.

Granted that track weight has materially increased—that more power is required to raise it—what has been happening to track labor? Twenty-five years ago, Americans, Swedes and Irish predominated in track work. Today, Italians, Greeks, Japanese and Mexicans are in the majority. The former were heavy, powerful men; while many of the latter are small of stature and light of weight.

The difference in weights—increased weight of track and decreased weight in men—can be equalized only through greater jack leverage. The problem is solved by using a lining bar. It constitutes everything required in a jack lever—length, strength and economy, plus weight. This discussion presupposes that all parts of the jack—standard, rack bar, pawls, socket and trunnions—are strong enough to withstand the loads which may be imposed as a consequence of the increased leverage.

CAPACITY OF TRACK JACKS

What is the lifting capacity difference between a 10-ton and a 15-ton track jack? The natural assumption would be 5 tons, but this is one of the peculiar fallacies founded on a custom that has grown as the track jack developed.

The lifting capacity of a jack is determined by the

weight suspended or applied to the end of its lever bar, and provided every factor of safety and strength has been incorporated, a so-called 10-ton jack with $\frac{3}{32}$-in. fulcrum and a 66-in. lever theoretically requires 208 lb. to balance 10 tons, and 312 lb. to balance 15 tons. Comparison of a 10-ton track jack with a 15-ton track jack of the same make proves that the fulcrum leverage and lifting capacity are the same. Height, weight and catalogued capacity do not affect the lifting power.

The pawls, socket and trunnions of the 10-ton track jack should, therefore, be identical in size and strength with those of the misnamed 15-ton track jack, because the 10-ton jack must raise and sustain just as heavy burdens. Thus we logically attain that uniformity and interchangeability of parts so widely endorsed by the purchasing, storekeeping and maintenance departments, as it reduces stock and simplifies the application of parts.

TYPES OF TRACK JACKS

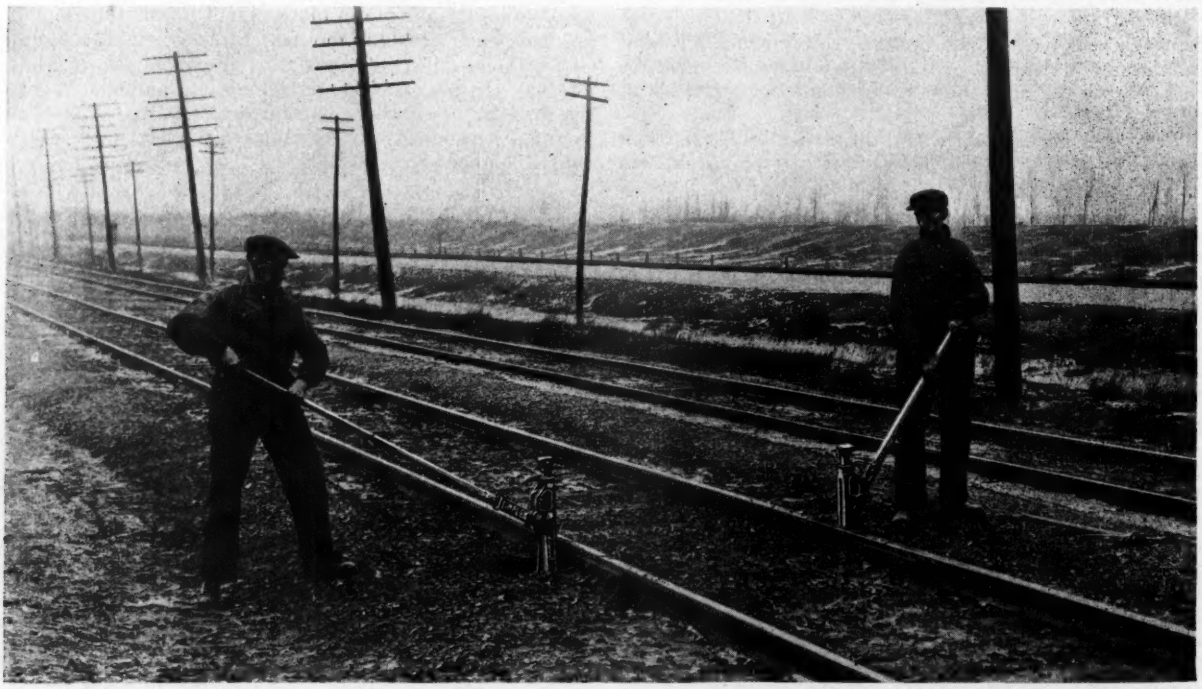
Track jacks are used for (1) ballasting new track, (2) reballasting new track, (3) reballasting old track, (4) giving old track a light raise to a face, and (5) picking up low joints. In ballasting new track, a jack with a high lift is necessary because the jack is working on a soft bottom and is likely to sink into the ground as the load is raised. Likewise in reballasting new track, the subgrade under the jack is often soft, so that here, too, a jack with a high lift is required. The second lift may be six or seven inches on a soft subgrade.

For reballasting on an old grade, a jack with a high lift is not necessary. A track cannot be raised as high as 8 or 10 in., with a single pair of jacks, without some danger of bending the joints; so where the raise is much greater than 5 or 6 in., it should be made in two or more lifts. On a solid subgrade, therefore, a 10-ton track jack of 14-in. raise is more than ample.

Another thing which limits the height of raise is the spread of ballast. It is neither easy nor economical to spread ballast heavy enough to provide for more than a six or seven-inch raise. If more ballast than this is distributed, some of it must be piled out on the shoulder and shoveled into the center.

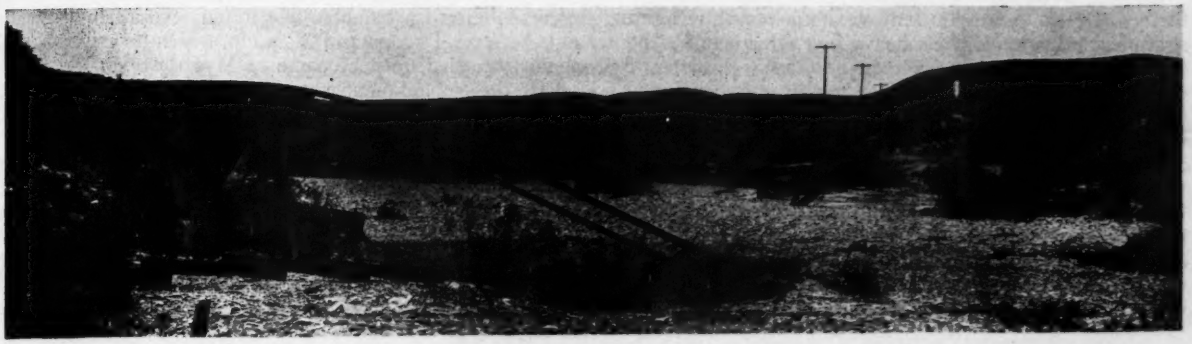
For giving track a light raise to a face where there is little or no new ballast applied, or for picking up low joints, a track jack with a high lift is not only unnecessary, but actually hinders the work. To my mind it represents a waste of money in the first cost as well as in the cost of doing work. It is only necessary to examine the unworn teeth on the racks of an old jack to prove that most track jacks have an unnecessarily high lift—which means increased first cost, increased maintenance cost and useless weight carried around by the section men.

I believe enough data have been given in this article to show that big savings are possible in the purchase and use of track jacks. Consideration of the facts leads me to make the following recommendations: (1) The 10-ton track jack, with a raise of 8 in., should be used on section work. (2) A 10-ton jack, with a raise of 14 in., should be used for reballasting on an old subgrade. (3) The working parts of the 10-ton and the so-called 15-ton track jacks should be made interchangeable. (4) All track jacks should be made with square sockets so that the lining bar may be efficiently used.



Jacking With Long and Short Handles, a Contrast

WHEEL BURNING.—This subject pertains to the failure of rails caused by the scoring and hardening of a layer of metal at the running surface of the head. The slipping of the driving wheels of the engine in starting a train causes the scoring. It is attended with local heating of the top of the head, intense heating as the sparks emitted indicate. The rapid abstraction of heat, by conductivity of the mass of metal of the head next below, results in the hardening of the surface metal. The depth of penetration of this hardened zone is not great, but this portion of the head is left in a very hard and very brittle state. Derailments result from the fracture of rails thus affected, the incipient points of rupture being located in or adjacent to the hardened metal.—*Report of the Safety Bureau, Interstate Commerce Commission.*



All That Was Left of One of the Trestles

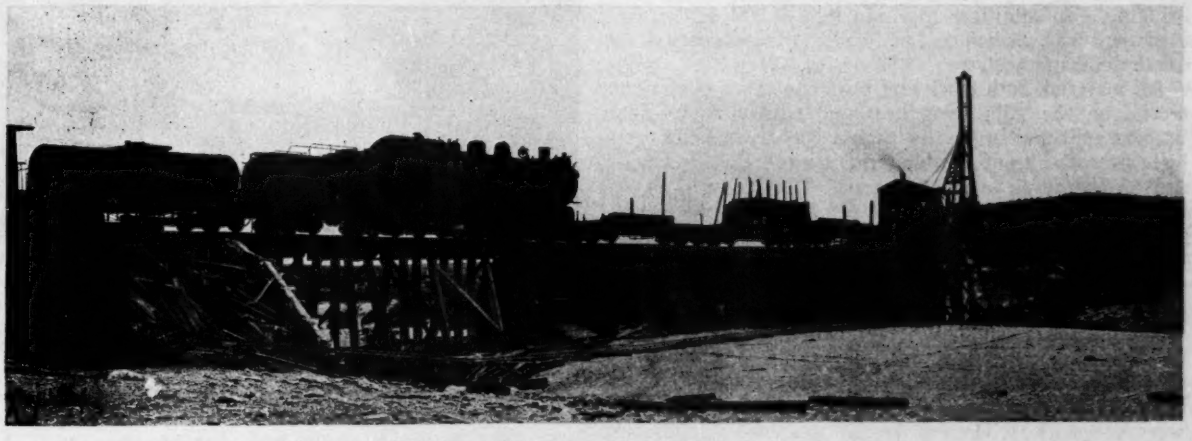
WASHOUTS REQUIRE EMERGENCY MEASURES

Southern Pacific Rebuilds Eight Bridges On Inaccessible Portion Of Texas Lines In Eight Days

AN UNUSUALLY destructive storm in southwest Texas this fall destroyed or severely damaged eight bridges and washed away a large amount of embankment on the El Paso division of the Southern Pacific, Texas Lines, so that this line was out of service for 12 days. The work of restoration was difficult on account of the inaccessibility of the location and the fact that there was a recurrence of high water for several days following the initial flood.

This storm was the result of the terrific hurricane that originated in the Bermudas, passing northwestward across the lower peninsula of Florida, thence west, striking the mainland at Corpus Christi, Tex., where it caused untold suffering and damage. Thence proceeding westward into Mexico it followed south of and parallel to the Rio Grande river, finally swinging northward into Arizona, where it died out. The fact that sea gulls and martins were observed as far west as El Paso is an indication that this is the same storm which passed over the Gulf of Mexico and gives a measure of its gigantic proportions.

The portion of the Southern Pacific which sustained the greatest damage is the territory between Langtry, Tex., and Osman. The line traverses a tortuous gorge between these two points, known as Osman canyon. This canyon is about 60 miles in length and has a drainage area of about 600 sq. mi., consisting of very steep, rocky slopes which are almost solid rock. The small tributaries leading to this canyon have a fall of from 50 to 350 ft. to the mile and the main canyon falls approximately 32 ft. to the mile. The meandering of this stream is also very irregular, so that the canyon swings from one side of the valley to the other with sharp curves, making a great many crossings necessary. The width of the canyon averages about 500 ft., one side being solid rock and almost perpendicular, while the opposite side slopes away at an angle of about 30 deg. except in places where the canyon becomes considerably narrower. One of these places is at Bridge 448-B, where the bed of the canyon is only about 150 ft. wide, so that the water at this point has an excessive velocity during a flood flow.



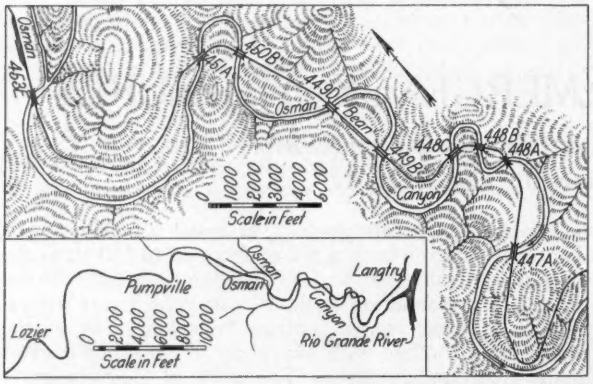
Manner of Closing an Opening with Cribbing and Trestle Bents

From these facts it can easily be seen that when an especially hard downpour occurs, similar to that on the evening of September 13, all the water on the drainage area immediately rushes into the canyon, causing a wave of water sometimes as high as 25 ft. to descend the canyon and carry practically everything before it.

Heavy flood periods occur in this country at intervals of four to six years. The rates of rainfall during these floods are excessive, amounting almost to cloudbursts. In this particular case it had been raining for 36 hr., during which time the precipitation was light, but on the evening of September 14 the downpour began and continued until daylight. During the morning hours of Sep-

tember 15 the precipitation was considerably lighter, again becoming excessively heavy just after noon. About six o'clock the section foreman at Osman reported the canyon full of water and the bridges in imminent danger of being swept away. The weather observer at Langtry reported a rainfall of 7½ in. during the first 36 hr. and also a wind averaging 50 miles per hour.

Seven bridges were completely destroyed, one bridge was moved down stream about four feet and had 10 bents washed from under it, while another bridge west of Osman had 700 ft. of the approach embankment washed out. Altogether 2,098 ft. of open deck trestle was completely destroyed, 375 ft. of open deck trestle was



Map of a Part of the Osman Canyon Showing Bridges Washed Out by the Flood

displaced but not destroyed and 144 ft. of deck plate girder bridge and 300 ft. of ballast deck trestle were completely destroyed, making in all a total loss of 2,542 ft. of bridging. In addition approximately 1,000 ft. of embankment was washed out, and 950 ft. of track was swept off the embankment.

All material, both track and bridge, was almost a complete loss, the rails being bent and twisted and bridge timbers split and broken in such a way as to be of very little use. Some of this material was carried down the canyon as far as five or six miles. Besides the above-mentioned damage considerable damage was done to telegraph wires and signal apparatus.

The bed of this canyon in most places is solid rock and does not permit the driving of piles, except in a few places where a shallow penetration may be obtained through a loose sand and gravel strata which is continually shifting with every rise. The sills of frame bents may be anchored by drilling and placing belts in the rock, but in cases where this was done the posts of the bents were swept away, leaving the sills fastened to the rock. For this reason it is exceedingly difficult to hold trestle structures in place when the canyon is flooded.

This stream has a considerable growth of dwarf cedars having a heavy mat of roots, which, on account of the thin stratum of soil, were easily displaced when the water rose. These accumulated on the upper sides of trestles, almost filling the openings between the bents, causing great pressure against the bridges. This caused the bents to be taken out from under the bridges, allowing the decks to fall into the water and be swept away. It is an established fact, from all indications on the ground, that several of these bridges were carried away because the heavy superstructures of the bridges from further up this canyon struck them with terrific force while being carried down stream in the swift current.

The superintendent of bridges was at Sanderson, 62 mi. west of Osman, on September 15, and at daybreak on the following morning he proceeded east with two bridge gangs looking for trouble. He found several small washouts between Dryden and Malvado, which he cribbed, and then proceeded until he came to Myers canyon crossing, where the embankment was side washed and taken out to the center line for a depth of 30 ft. About 500 cu. yds. of embankment was lost at this place.

More trouble was encountered further east and at one bridge he found 680 ft. of the approach embankments washed out. This was cribbed on the morning of the 17th, after which the outfit moved to Osman. During the night of the 17th another hard rain came and the cribbing put in at one of the bridges was washed away a second time, the breach being widened to 275 feet. This was cribbed again by section forces. On the 19th this opening was again widened to 297 ft., but no great amount of cribbing was lost.

Work was begun on the first bridge washout east of Osman at bridge 451-A on the morning of the 19th and was completed 6 p. m. on the 21st. The next bridge was 450-B, which was restored at 5 p. m. on the 22nd. Work on bridge 449-D, the next bridge, was begun on the evening of the 22nd and completed during the forenoon of the 24th. The last bridge to be constructed by the gangs on the west front was bridge 449-B, which was

Plate Girder Bridge Destroyed by the Flood

begun the forenoon of the 24th and completed at 5:30 p. m. on the 26th.

The force on the west front consisted of two bridge gangs from the El Paso division and two from the Tucson division, including in all about 55 bridge men. About 150 track laborers were used for carrying forward material and building cribs. One pile driver was also employed to handle the material.

On the east front the first bridge washed out was 447-A. Work began here on the morning of the 18th and it was completed the evening of the 20th. Bridge 448-A, the next bridge, was not completed until the morning of the 24th on account of heavy rains bringing the water up in the canyon, taking out some of the cribbing and otherwise delaying the work. Bridge 448-B was completed at 3:30 p. m. on the 25th. The last bridge built on the east front was bridge 448-C, which was completed by 6 p. m. on the 26th.

The forces on the east front consisted of four bridge gangs, with 48 men in all. Three gangs of track laborers, 102 men, were employed in handling material. Two pile drivers were used, one to handle material and the other at the front to drive a number of bents required on account of high water.

Temporary tracks were constructed from the material piles at the east end of each bridge down into the bed of the canyon. Then push cars were used to transport the bridge timbers and ties for cribbing ahead. This arrangement proved very satisfactory and did much to hurry the work.

Insuring Safety in Steel Erection*

BY COL. E. A. GIBBS,
With McClintic-Marshall Company, Pittsburgh, Pa.

STEEL ERECTION, like other outside construction work, is done under more variable conditions than shop work, for the reason that the conditions are continually changing, while in the shop many conditions affecting accidents are fixed. The weather plays a much more important part in the field than in the shop. The force of workmen is also much less stable. With the field force constantly changing, it is much more difficult to educate the men to safety and to avoid getting men who are unsafe on the work.

There are, however, certain differences between steel erection and general construction: The loads are generally much heavier and are handled under more varying conditions and at a greater distance from the ground. There is an element of risk in every lift. While the derrick may have been tested throughout and proven safe, an accident may be caused by a bridgeman making one careless hitch on a load of beams.

The appliances for erecting steel work have been developed and increased greatly during the past 20 years and erection is relatively much more safe. Nevertheless, many new difficulties have arisen. The average weight of pieces to be handled has greatly increased, while certain limiting features have remained unchanged, such as track clearance and gage. A girder may increase in weight, but the derrick car that handles it must run on and be supported by the same track as previously. This increased weight has had one benefit. Heavy members cannot be juggled and handled in any manner that the foreman desires. The equipment can be designed to handle these in only a few ways and the foreman must be governed accordingly. Therefore, the work is likely done as the design of the equipment contemplates and with corresponding safety.

Accidents are divided into two classes, real and preventable. Real accidents are those which occur through no neglect on the part of the workmen or the employer which could reasonably be expected to be foreseen and prevented. Preventable accidents are those which could have been avoided, had either of the men or those in authority over them exercisd the proper amount of vigilance. It is conceded that well over half of all accidents are preventable and the proportion is probably higher. We are, of course, concerned with both classes of accidents, but particularly with those that can be preventeo. Preventable accidents maye be divided into three classes as follows:

1. Accidents due to workmen themselves by reason of being physically or mentally incapacitated; i. e., ignorant, inexperienced, intemperate, careless or reckless, acting the fool, or actually disobedient.

2. Accidents due to foremen: Improper selection of men placed in charge of work or doing the work, inadequate instruction to workmen, putting men or allowing them to go into dangerous places unnecessarily, lack of vigilance and orderliness on the work, and failure to investigate questions of safety raised by workmen.

3. Accidents due to superiors, by reason of improper selection of foremen, safeguards, equipment for doing the work and instructions regarding its use.

The foremen, while still skeptical as to the value of certain expedients for safety, can be educated more easily as they form a small class. As their tenure of employment depends on the results they produce it isn't hard to impress them with the effect of accidents on their work. It isn't so easy to get them to *enforce* safety methods. The conditions on a job are changing rapidly and the foreman is crowded to make time. Only constant pressure on the question of safety and using *every* accident to point out the neglect of foremen or men will bring results.

The workmen are by nature and training a daring class of men and instinctively feel that their courage and skill is questioned when they are asked to comply with many of the expedients for safety. However, they can and must be educated to take proper precautions to protect themselves and their fellow-workmen. Bulletins, notices and placards of various kinds containing written and illustrated cautions and effects of neglect are very good. Our company, in 1910, issued a book to its foremen containing instructions and cautions for the prevention of accidents. We also started at that time to post a bulletin with certain of the most common faults of workmen and how to avoid them. A small copy of this bulletin is handed to each bridgeman whom we employ. It contains several short paragraphs, as follows:

Don't Be Reckless. More accidents occur through recklessness than any other cause. Don't walk on rods. Don't ride a load. Don't ride on a locomotive crane.

Don't Be Careless. Look where you step, and be sure that on what you step is safe and secure. Don't step on ends of loose plank. Don't start to slide down a line unless you are sure the ends are fastened.

Be Orderly. Do whatever you do in an orderly, careful manner. Pile material so that it cannot roll, fall, tumble, or be blown over. Don't let tools or equipment, such as bolts, nuts, drift pins, blocks, dolly bars, etc., lie around so that they can be knocked off the work or so that anyone can fall over them.

Unfit Condition. Don't go to work if you have been drinking or do not feel well. If you are lame or have any defect in hearing or eyesight you should not work at this business, as by so doing you endanger your own and fellow workmen's lives. If you are inexperienced in or unsuited for the work to be done, don't undertake it.

Be Vigilant! Watch What You Are Doing. Don't stand or work under a load. Don't go in the "sight" of a line or stand in front of a snatch block. Don't work on or about a crane runway when the crane is in use unless there is a stop between you and the crane.

Don't Use Unfit Tools. Be sure the tools and equipment you use are in good working order. If they are not, don't use them.

*Abstracted from a paper presented before the Construction Section of the Eighth Annual Safety Congress, Cleveland, Ohio, October 3, 1919.

Don't Work With Men Who Don't Osberve These Rules. The first requirement for safety in erection is to have the proper equipment. Foremen and workmen cannot be expected to take the necessary precaution if they are not provided with proper equipment in first-class condition. And it is not enough to provide first-class equipment. It must be kept in good condition by constant attention on the job and by overhauling at the completion of the job if necessary.

Some of the principles observed by our company regarding equipment are:

1. That no wooden travelers or derricks are used except very light derricks and jinnywinks.
2. That all castings in erection equipment carrying any strain are made of steel. We make all of our sheaves for cable blocks, except small blocks for ⅝-in. cable, of steel. All castings subjected to bending strains are made of vanadium steel. Vanadium insures a more uniform casting and tends to eliminate blowholes.
3. That forgings of importance such as the headblock of a derrick car are made of nickel steel.
4. That the very best manila lines are used.
5. That cable slings are used instead of chains. This is very important.
6. That an automatic brake in addition to a mechanical brake is provided on all electric hoists.

In the erection of ordinary work the equipment provided, if it is of the best quality, is amply strong for the purpose. It simply requires proper handling and reasonable care.

For the heavier classes of work, heavy and frequently special equipment must be used. This equipment requires good designing and the best materials. Good designing implies a thorough knowledge of how the equipment is to be used, and the provision for all reasonable uses to which it may be put. It is the duty of the foreman, after being properly instructed, to see that the equipment is put to no uses for which it was not intended unless necessary, and then only after proper investigation by an engineer.

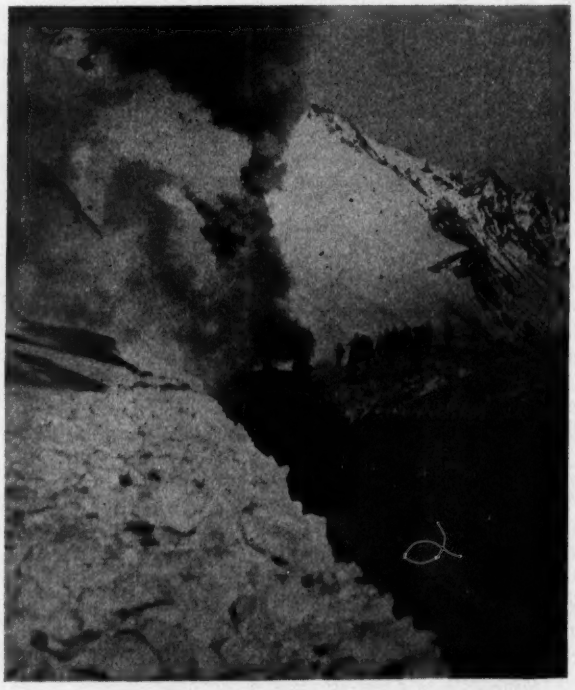
Erection equipment should be most carefully inspected during its manufacture and test reports required for steel castings, all alloy metals and steel cables. The assembling and erection of a traveler or heavy derrick should be carefully done to insure that no stresses are introduced by improper alinement.

Instructions should be issued as to just how equipment on heavy work is to be used and nothing left to chance. A movement of a very short distance in the setting of a traveler or in the radius of a heavy boom may be perfectly safe as far as the equipment itself is concerned, but may endanger the falsework or the structure.

In the erection of falsework, great care and an accurate knowledge of conditions is necessary. Timber should be carefully inspected and none but of good quality used. In case mudsills are used it is necessary to examine the soil carefully and provide sufficient mudsills to support the load with ample safety. The matter of bracing the falsework bents themselves, their connection by bracing and struts, and the fastening of the end bents to the piers or abutments so as to prevent any longitudinal movement of falsework, are all points where too much care cannot be exercised.

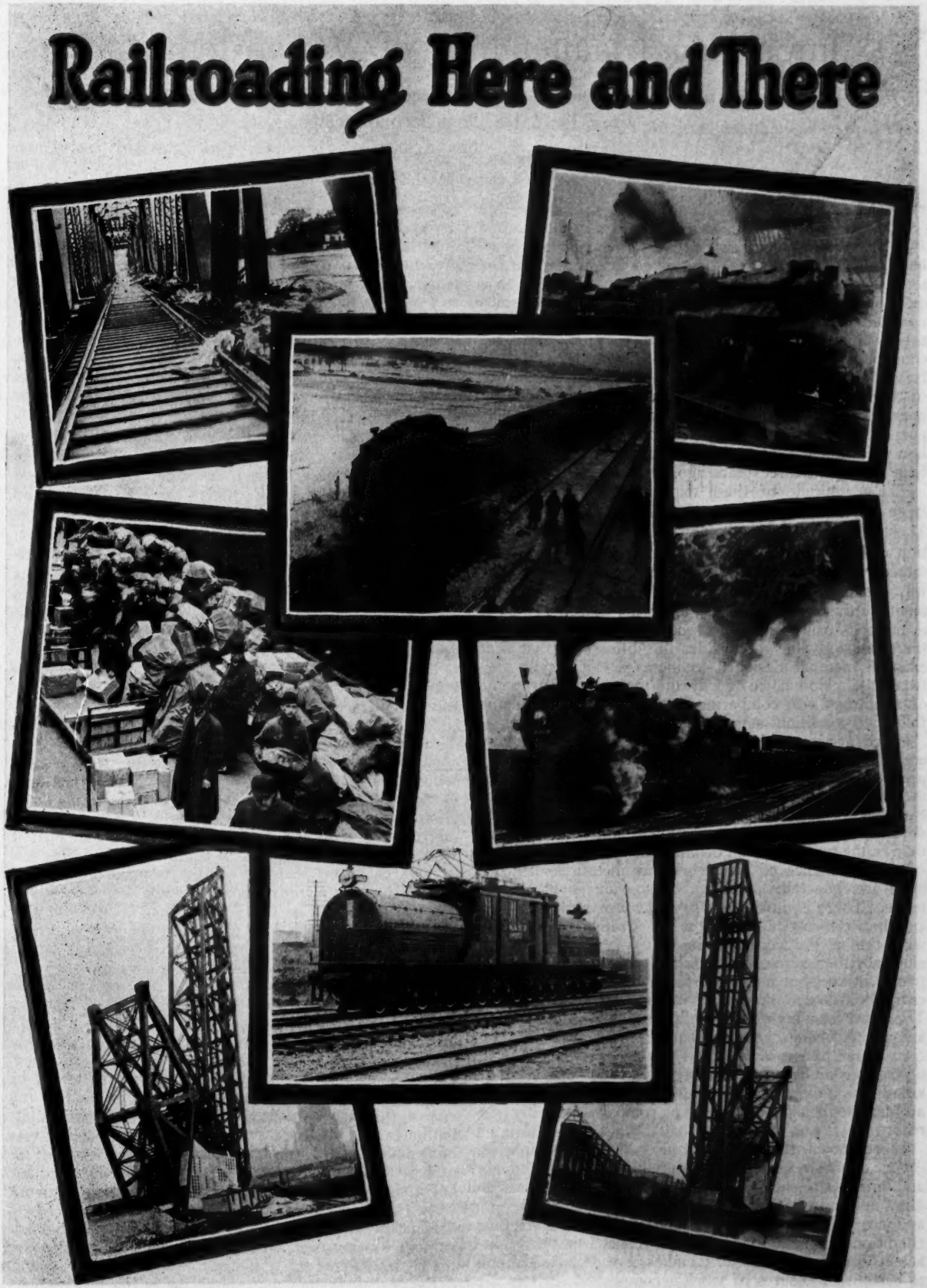
Following are some cautions that if followed will prevent many of the accidents in steel erection:

1. Select the proper man for the particular task in hand.
2. Do not order men to work in unnecessarily dangerous places, and be on the alert to see that they do not run unnecessary risks of their own volition.
3. Do not allow the men to work on corrugated iron roofs or steel when there is a coating of ice thereon.
4. Walking on rods, riding loads or locomotive cranes, sliding down lines without inspecting the fastening, standing in the bight of a line or in front of a gate block, are all unnecessary risks and should not be permitted.
5. Do not permit men to work about crane runways without placing an effective stop between the men and the traveling crane, and see that the electric wires are properly insulated.
6. Require the rivet boss to inspect carefully all riveting scaffolds. Improperly hung scaffolds have caused many serious accidents. Only the best material should be employed. Clear spruce is the best.
7. Pipe used as needle beams should not be spliced.
8. All scaffold plank should have a stop bolt about six inches from each end to prevent it from slipping off the needle beam and if the scaffold is inclined it should have cleats nailed on the plank. All scaffold material should be tested for twice the load it is expected to carry. Even this care will not suffice unless the men are careful. This was demonstrated in a case where a riveting gang used its scaffold as a brace for an air buckup. The scaffold—amply strong for its purpose—broke under this sudden additional load and the men fell into the river.
9. On high bridge work, scaffolds should be provided with a railing. This is required by law in some states.
10. Piling of material must be carefully watched, particularly with heavy work. Skids should be amply heavy and level, and the piles not top heavy. Poor piling of material is responsible for a large number of accidents.
11. When it is necessary for men to work above other men, put up a danger sign calling attention to the fact that men are working overhead.
12. Keeping small tools in condition will avoid many accidents.
13. Require men to wear goggles while chipping, although the men dislike to do so.
14. In the use of cable slings, inspect them frequently and keep them properly oiled, and in handling heavy loads pad the sharp corners to prevent cutting the cable.



Railroading in the Andes

Railroading Here and There



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(1) *Southern Floods Cause Serious Washouts in December.* (2) *Northern Blizzards Impede Traffic Movement.*
(3) *Broken Rail Wrecks Train Near Chicago.*
(4) *Christmas Mail Congests Postal Facilities.* (5) *First Coal Train Reaches Chicago After Strike Settlement.*
(6) *Chicago, Milwaukee & St. Paul Tests New Electric Locomotives.*
(7 and 8) *St. Charles Air Line Bridge Placed in Service at Chicago Breaks Record for Single Leaf Bascule Span.*

Improving Maintenance of Way Methods*

Increased Efficiency and Better Records Are Necessary If the Work Is to Be Done Economically

By A. M. BURT
Assistant Director, Division of Operation, U. S. Railroad Administration

THE EXPENDITURE for maintenance of way and structures on the Class 1 railroads of the United States for the year 1919 will be in the neighborhood of $750,000,000, representing about one-sixth of the total operating expenses of these roads. Reduced to a daily basis, this means that it requires more than two million dollars a day to keep the railroads in condition for use. While this is much less than the amount spent for conducting transportation and considerably less than the cost of maintenance of equipment, it is nevertheless one of the major items that go to make up the total cost of operation. The increased cost for maintenance of way purposes has been very large, so that now fully one million dollars a day more is being spent for this purpose than was spent three years ago.

The magnitude of these expenditures and the very large increases should make us all stop and take thought. The question that immediately presents itself in connection with them is whether progress is being made toward increased efficiency—if so, whether the maintenance of way department is keeping in step with the other departments in this essential matter, and whether some changes in methods can be made to secure better results. It is, therefore, of value to consider the differences that now exist in methods designed to increase efficiency as between the maintenance of way and the other departments of a railroad. In comparing these methods we find the following conditions standing out very prominently:

In connection with transportation operations many measures of work done have been devised and are in daily use and the supervisory officer is constantly in touch with the situation through various reports. In maintenance of equipment work some measures of work done have been devised, although their application is much less general than in the transportation department.

In maintenance of way work any measures of work done are, generally speaking, conspicuous by their absence. There is, in this work, no way of striking a balance between cost and output or of showing in any definite way whether the work is being done with greater or less efficiency than heretofore. On many roads a budget system is in use, but no matter how well such a system is carried out it does not supply the measure of work done. The supervisor knows that he has been allowed a certain amount and believes that he has spent this amount judiciously, but he has no way of knowing definitely whether he has accomplished more or less than the supervisor on an adjoining district or of knowing whether he is making an improvement or the reverse as compared with his past record.

It seems clear that some measure of work accomplished is very desirable. There is nothing that stimulates thought and initiative to such an extent as a little competition with one's neighbor. It puts an element of sport into the job and not only helps the work, but is a most developing condition for the individual. It is realized that the character of maintenance work makes it especially difficult to establish measures of work accomplished such as are in common use in connection with transportation matters, but there is apparently a tendency to magnify the difficulties of the subject and to assume the attitude, "What's the use? It can't be done." It surely must and will be done in a much larger measure than it is being done at present, and, if it is to be well done, the practical maintenance men must take an active interest in the subject and do their bit in solving the problem. When we have done anything in one way for years we all are apt to consider that way as being the only right one and to consider the subject as a closed book. This, in a measure, is the present attitude of mind, but we have got to shake ourselves loose from such an attitude if progress is to be made.

If the practical maintenance men do not take an active part in this matter there is danger of the work being put on a statistical basis to such an extent that no good results will be accomplished. There has been some of this in the past in other departments, where in some instances statistics have been undertaken so involved in detail that the result was nothing more than a work of the imagination. The maintenance men must make a special effort to insure against such a mistake as this in connection with their work. On the other hand, some progress is possible in simple ways, and something of this kind must be undertaken.

To illustrate what might be done but is not: Several years ago a certain railroad used its maintenance forces for packing ice. The work was completed in December or January, and the following spring, about the time the mosquitoes began to get bad, a statement of the cost of the work was returned to the division from some source generally unknown. This report was turned over to the roadmaster, who was then very much engrossed in his spring work and who usually classified it as "Interesting, if true," checked it with a lead pencil and filed it away in its proper box where it could be used by his clerk in the event of his being called upon to make any explanation. No daily records were kept while the work was in progress.

Some time later the work of packing the ice was turned over to a contractor, and immediately the job was organized on a business basis. The foremen were required to make a report each night showing the amount of ice packed, the payroll in total and per ton and the delays in time and labor cost. In this way each foreman was kept in close touch with his work without being unreasonably burdened with details. If he was delayed for switching, he had something tangible to show the yardmaster; if he had an unreasonable amount of trouble with his hoisting engine, the fact immediately showed up and received attention; or, if his force was out of balance, that fact was immediately called to his attention by the increase in his unit cost. It would have been entirely feasible to have had a similar plan when the railroad was doing the work with its own forces, but no such plan was used. Many similar instances could be cited, going to show that advantage has not been taken of the opportunities that are readily available.

Every maintenance man should be giving this problem the most thoughtful and constant attention, and without question the subject deserves more attention from managers than it has had in the past.

*From the U. S. Railroad Administration Bulletin.

The following is offered by way of suggestion:

1. Better facilities should be provided for the exchange of ideas. Local roadmasters' and supervisors' associations should be encouraged. Such associations are most helpful if discussions are kept along general lines and away from matters having only a narrow and local interest. The time of the men away from their routine work is well spent. There is less experience with foremen's associations, but apparently considerable benefit might be derived from them.

2. Attendance at national maintenance of way meetings should be actively encouraged and liberal allowances should be made for the expenses of men attending such meetings. The men always bring back ideas and inspirations that result in more efficient work.

3. The question of getting a more general dissemination of ideas and information through publications should be considered. There should be a more general use of the maintenance of way periodicals.

4. The problem should be worked out from the inside and by the talent already on the individual railroads. There is plenty of such talent, and, by encouraging the local men to work out the problems, morale will be improved. They can do the work much better than it can possibly be done by any so-called efficiency expert from the outside. In doing this each man should be given proper credit for his ideas and his part in the work.

The New Year is at hand, and the opportunity of the maintenance of way man is here. We look forward, confidently, to his making the most of that opportunity.

Timber Perforating Patent Given to Public

ON OCTOBER 6, 1919, all the rights of O. P. M. Goss in his letters patent No. 1252428, issued on January 8, 1918, and covering a process for perforating cross-ties and timbers, were acquired by Chas. R. McCormick & Co., San Francisco, Cal.; The St. Helens Creosoting Company, St. Helens, Ore.; The J. M. Coleman Company, Seattle, Wash.; the Pacific Creosoting Company, Seattle, Wash.; the St. Paul & Tacoma Lumber Company, Tacoma, Wash., and the Columbia Creosoting Company, Portland, Ore. These companies, together with Mr. Goss, as owners of the above patent, have dedicated it to the public for all time and the duly executed dedicating document has been filed with the Patent Office in Washington, D. C.

The Goss patent covers a method of perforating timber before treatment, which was described in considerable detail in an article by O. P. M. Goss on page 120 of the April, 1917, issue of the *Railway Maintenance Engineer*. The direct causes which led to the development of this process were the difficulties and uncertainties encountered in devising a satisfactory method for treating Douglas fir cross-ties and timbers. This wood was so refractory and so non-uniform in its resistance to the penetration of preservatives when subjected to standard treatments, that the results were seldom uniformly satisfactory. This difficulty existed particularly in the treatment of sawn Douglas fir where preservatives had to be injected into the heart wood and it was not uncommon to find a very marked difference in the depth of the penetration in the same piece of fir timber and over different areas of its surface.

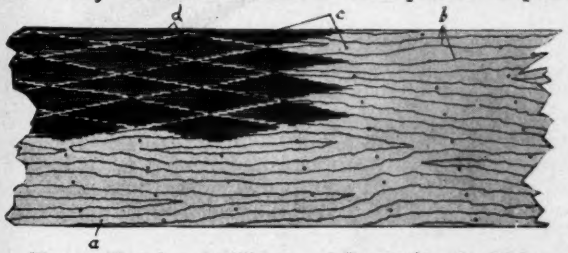


Fig. 1. Showing the Manner of Staggering the Holes

These obstacles were overcome by the perforating process, which consisted of a method of puncturing the surface of the wood to be treated, by holes systematically located at uniform distances apart, both transversely and longitudinally, these distances depending on the known normal absorption of the preservative with and across the grain of the wood under given time of immersion, pressure and size of perforations. The result of the treatment gives a substantially uniform penetration of preservative to a depth equal to that of the perforations and without waste.

Two diagrammatical views of a block of wood in the process of treatment are shown in Figs. 1 and 2, where (a) represents the timber, (b) the grain, (c) the perforations and (d) the areas over which the preservative spreads from each hole. It will be noted that the extent of the absorption of the preservative is much greater along the grain of the wood and as this extent of absorption can be determined by experiment, the perforations can be so located that the minimum areas impregnated will overlap at their margins. In the illustrations the adjacent treated areas have not yet come together, as will be the case when the preservative has been fully absorbed by the timber. By the staggering of the perforations, the uniform and even treatment of the timber was promoted without the danger of the holes being so close together as to appreciably reduce the transverse strength of the timber.

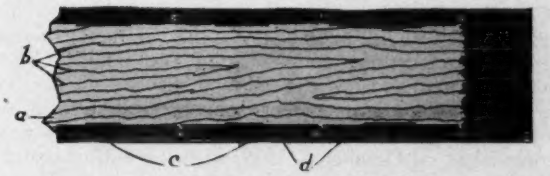


Fig. 2. Section Showing the Penetration Secured

A complete and practically uniform penetration was obtained by the open tank method of treating Douglas fir, by previously perforating the timber with small holes 1/16 in. in diameter and spaced 4 in. apart along the grain and ⅛ in. across the grain. In the open tank method the pieces to be treated were boiled in a preservative oil for four hours at a temperature of 215 deg. F., after which the material was allowed to cool in the oil, the total time of treatment being approximately 12 hours. A similar penetration was obtained under pressure by perforating the wood to a depth of ¾ in. and ⅛ in. wide across the grain, the holes being spaced 7 in. with ⅜ in. across the grain. The pieces were then placed in a pressure retort, the preservative oil introduced and raised to a temperature of 170 deg. F. The material was subjected to this temperature for four hours, after which a pressure of 120 lb. per sq. in. was applied. About one hour was required to raise the pressure to 120 lb., where it was held for a period of two hours, the temperature remaining the same.

One of the advantages claimed for this treatment is that the perforation of cross-ties and timbers will not only control or prevent the "checking" of material so

commonly found, especially in sawn Douglas fir, and assure an even penetration of the preservative, but it will also accomplish the important commercial result of reducing the period of treatment required to inject a given amount of preservative into the timber. While this process was developed in the study of the treatment of Douglas fir, it will be applicable as well to other timbers, such as Southern pine and oak. The application of the perforating process to bridge and structural timbers may require some modification in the cross section designed to carry standard loading, but it is not expected that the perforating will be found to reduce the strength of timber materially, because it is done along the fiber of the wood and not across the grain. The machinery which has been used in this process, as built and designed to date, is applicable only to dimension stock such as cross-ties, switch-ties, bridge timbers and structural timbers. Studies are being made, however, in the design of a machine that is expected to perforate holes and piling with an equal amount of satisfaction.

Shortly after the patent was granted in January, 1918, its control was vested in Mr. Goss and the Association of Creosoting Companies of the Pacific Coast. No development progress was made during the European war, but an attempt was made by the owners, early in 1919, to develop the use of perforating before treatment. Royalty charges of one-half cent per cross-tie and 15 cents per 1,000 bd. ft. for lumber were adopted and announced to railroad and commercial treating plants of the United States. These charges met with strong opposition. Edmund M. Blake, production engineer of the Chas. R. McCormick & Co., San Francisco, Cal., believing that the best interests of the Douglas fir industry in the Pacific northwest and of the creosoting companies of the Pacific Coast would be furthered by the elimination of all royalty charges under the Goss patent, took the initiative in an effort to bring about this result. This was successfully accomplished on October 6, 1919, with the full co-operation of the creosoting companies mentioned at the beginning, and composing the Association of Creosoting Companies of the Pacific Coast.

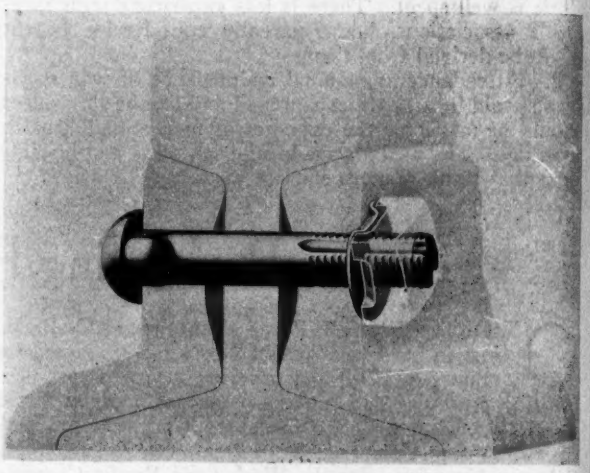
A NEW NUT LOCK

ONE OF THE MORE recent developments in the field of locks to prevent the turning of the nut on a bolt is the "Safety Nut and Bolt" marketed by the Safety Nut Bolt Company, Cleveland, Ohio. This lock is of the type in which the nut is prevented from turning by a washer so designed that it cannot rotate on the bolt.

The construction is shown in the drawings. The washer is secured against turning on the bolt because it has two interior lugs that fit into grooves cut in opposite sides of the bolt and extending from the end of the latter to some distance beyond the end of the threads. The nut is prevented from turning after it has been set down tight by bending up the washer into recesses or chucks formed in the four sides of the lower face of the nut.

While the principle of this construction is simple, considerable refinement has been effected in working out the design in order to secure the most practical results. For instance, the grooves cut in the bolt are of such shape that the washer fits loosely over the bolt for a length about equal to the thickness of the nut, but for the remaining length the lugs on the washer fit tightly in the grooves, thereby anchoring the washer firmly against any lateral movement, although it is readily forced down the length of the bolt by the turning up of the nut. The upsetting of the edge of the washer into the cups on the bottom of the nut is accomplished by means of a cape chisel and as this may be accomplished anywhere on the circumference of the washer, it is readily seen that the nut may be secured against turning at any angle in its turn.

After a careful study of the operation of this form of bolt and nut lock as used on rail joints, it has been found that the proper procedure for the application of new bolts to track is as follows: When first applied the



The Nut Lock Applied to a Rail Joint

nut is tightened as far as possible and allowed to remain for a period of about 10 days without upsetting the washer. Within this time the action of the traffic in passing over the joint will dispose of the rough scale or other occluding surfaces on the rail and the splice bars so that they may come in closer contact and introduce con-

The Bolt, Nut and Washer

siderable play in the bolts. At the end of this time the play in the bolts should be taken up by a final tightening of the nut after which the nuts should be locked by means of the washer. If the operation is handled in this manner it is believed that further tightening of the nuts will not be required for a long time.

This form of bolt and nut was subjected to severe tests in a No. 8 cast filled frog subjected to heavy traffic. The bolts were in service 18 months during which time the wing rails were replaced. The second set of wing rails was practically worn out at the end of the test period, whereas, the bolts were still thoroughly effective.

OLD POP, THE DEPENDABLE

BY CHARLES H. SMITH

SOMEONE had blundered somewhere on the last steel laid by the C. G. R. & W. R. R. Whether it was the management who, through a false idea of economy, had ordered the purchasing agent to curtail inspection, or whether the manufacturers were to blame the trackmen did not know. What they did know, however, was that the 75 miles of new 90-lb. steel which had been laid last summer was mighty poor stuff. It was not "standing up" at all. But they did not discover this fact positively until in January after the new rail had been in use for nearly six months.

They had viewed the new steel from the first with suspicion. During June and July when they had gone out on the work train and, with the assistance of a rail-loader, had distributed many carloads of it they had noticed the lighter base, the slightly lower height and the lighter appearance generally of the new rail when contrasted with the old. But this was partly due to their imagination, for the new steel was just as heavy as the old—90 lb. to the yard—and any differences they saw were in the slightly different patterns. Still, in spite of their suspicions, the trackmen were of an open mind regarding it. "It may be all right," they said. But they couldn't be sure until it had seen service.

The steel gangs had hustled the new rail in and by September the work had been finished—the old rails, angle bars and bolts loaded and sent to branch lines or placed in sidings. Then the section crews took charge of it and began their daily surveillance of the track to keep it in repair. September, October and November had passed and the new steel seemed to be fairly O. K. To be sure, Bert Douglas, foreman of Section D-7, had found four broken rails since it had been laid, and other foremen had discovered one or two broken rails on their sections. Still the best of steel will break occasionally and so this could hardly condemn it. What Douglas remarked, though, was: "If these rails break in such mild fall weather as we've been having, what will they do when winter sets in?"

Douglas' section was a bad one. It had eight curves on its eight miles of track and as might be imagined there was very little level roadbed on it. Going east from the west end, it sloped down for three miles to the valley of the Manitee river, which was crossed by a long iron bridge. Then it wound its snaky way up for four miles to the top of Benson's Hill, where Douglas had two 80-car sidings to maintain. From here the grade slipped downward to Anchorville, where his car house was located. At this point it was over the range of hills and the track shot almost straight to the state capital over level ground. In addition to this succession of curves and grades there was another factor which made Douglas' section one of the most difficult to maintain on the sub-division. This was the perpetual slow order over the Manitee river bridge. The long, heavy freights were compelled to apply brakes upon approaching it and come to a grinding 20 miles per hour while passing over it and the passenger trains had to slow down to 40 miles when they could have easily made almost double that speed. So it was that Section D-7 was an exceptionally difficult one to keep up to standard and in view of these facts it does not seem strange that Foreman Douglas should have found more broken rails than had any other foreman on the sub-division.

As January drew near the weather grew colder. Each morning when the trackmen came to work every fence, every bush and tree was white with the long glistening particles of hoar frost and the covering of snow on the ground that had fallen earlier in the month crunched coldly beneath their feet. While they were heating the carburetor of the motor car they stamped their feet and swung their arms in an effort to keep their blood in circulation. During the day the sun shone brightly but coldly, hardly melting the ends of the hoar frost. It was, as Douglas said, snug winter weather.

At this time the new steel began to fail badly. Every morning the first thing that the men on Section D-7 did was to go over the entire section watching for broken rails. Usually they found one or two. At first they changed them out immediately upon finding them, but they soon ran out of rails and then had to simply drill the broken ends of the rail and bolt them together with angle bars. Never had Douglas seen so many broken rails as he had that January and when finding one or more became almost a daily occurrence he thought it time to confer with Roadmaster Eggleston about the situation. Eggleston advised a close patrol of the track during the day, making a trip over the section the first thing in the morning and another trip over it just before quitting for the night. He also directed Douglas to put on a track walker nights.

It thus happened that in the middle of January Douglas hired Old Pop Williams to patrol the track nights. Pop was nearly 60 years old, but he had a rugged constitution, having been a lumber jack in the North woods a part of his days. Furthermore, he was an experienced trackman. But the biggest recommendation of all was that Old Pop was absolutely dependable. Douglas knew that if Pop did the track walking he would be on the job all of the time. And he did not know this about some of the younger men he might have hired instead. On the frosty nights when the mercury creeps downward lower and lower as the night advances these younger fellows might seek the solace of the warm atmosphere around the big round oak heaters of their farmer acquaintances along the right of way. But Douglas knew that Pop never would.

Pop had been on the job nearly a month doing his duty in an entirely satisfactory manner. Along the section at half-mile intervals Douglas had placed 16 little piles of angle bars and spikes for his use. Every night promptly at seven P. M. the old man would report at the car house, fill his red and white lanterns, slip some torpedoes and a few red fusees into his pocket, fill another pocket with spikes, and, shouldering his spike maul, start out on his lonely vigil. His lanterns were always lighted, but the red one was "blinded" with an old sack so that trains would not be stopped unnecessarily by it. Should the

occasion arise, however, Pop could quickly tear off the sack and bring a train to a stop without delay. Almost every night he would find one broken rail, sometimes he would find two or even three. Then he would go to the nearest pile of angle bars and, getting a couple of them, would spike them down securely, one on each side of the break, thus making temporary repairs until the crew could drill the broken ends and bolt them together the next morning.

On the night of February seventeenth when Douglas and his men rolled their motor car into the car house the weather looked ominous. Early in the morning the sun had shone for an hour or so, a sun-dog on either side. Then a sullen gray sky had threatened all day long. About five o'clock the wind began to rise, coming from the Northwest, and by six the air was full of snow. "I don't like the looks of it," said Douglas as he surveyed the storm. "We may get a blizzard before it gets through."

By six-thirty his prediction seemed about to be verified, for the wind had increased in force and drove the snow before it thicker and faster. After Douglas had eaten his supper he went back to the car house. He wanted to talk with Pop before he went out. When he came in sight of it he saw a light shining through the window—Old Pop was already on the job cleaning and filling his lanterns. Douglas entered and quickly closed the door behind him to shut out the icy blasts.

"Good evening, Pop," said Douglas. "A pretty rough night outside, to-night."

"Good evening, Mr. Douglas. It is that. I'm thinkin' we're going to have a bad one," replied Pop, as he paused in his occupation of cleaning a lantern globe, a bunch of waste in his hand.

"And I've been thinking that maybe I'd better send a man out with you to-night, it looks so bad. What do you think about it?" asked Douglas.

Pop laughed indulgently. "I guess you don't know, Mr. Douglas, that I've been out in some of the worst Dakota blizzards you ever heard about. Don't worry about me. I'll take care of the job all right." He finished polishing the globe as he spoke and, placing it in the lantern frame, snapped the top down.

"Well—I suppose you know what you can stand, Pop, but don't take any chances. It's a bitter cold night and the snow makes it bad about seeing trains. Watch sharp for them. If anything goes wrong stop at the nearest farmhouse and phone me about it."

"All right, Mr. Douglas. I'll do that. But here's hoping that nothing does go wrong on such a wild night as this is."

Picking up his two lanterns and his spike maul Pop walked to the door. Douglas followed him out and locked it.

"You have torpedoes and fusees all right, haven't you?" asked the foreman as he turned to go back home.

"Yes, sir, I sure have," answered Pop.

"All right. Good-night, Pop."

"Good-night, Mr. Douglas."

Turning westward, Pop started down the track, holding his white lantern close to the ties in order to watch the rails. The force of the wind was drifting the snow, but as yet the rails were entirely bare except in the cuts. The walking was not bad, but the terrific force of the wind at times nearly swept him from his feet and caused him to bend forward in an effort to brace himself against it. Slowly he made his way up the grade of Benson's Hill, watching the while the rails on either side of him. Not until he was nearly upon it did he see the gleam of the green switch light of the first switch. At frequent intervals he turned around in an effort to detect any trains following him. One by one he passed the other three switch lamps on the two sidings. Just beyond the last switch a long freight train swept past him. He was now well on his way down the four mile grade to the Manitee river bridge. From here on his progress was slower, for not only was the wind blowing stronger but the snow began to make walking more difficult in the cuts and it was almost impossible to watch the rails without going very slowly. But Pop kept steadily on his way around one curve after another until he finally reached the bridge. He was then over five miles of his track and it had taken him nearly three hours. But he knew that in those five miles there were no broken rails.

Standing on the end of the bridge he listened intently before starting across, for the bridge was a high and long one and he had no desire to be caught out on it by a train. Nothing was to be heard, however, and so he started across. Out on the bridge, nearly 60 ft. above the frozen river, the wind almost tore the clothing from his body, such was its fury in its clean sweep down through the valley. Fighting his way to the opposite side Pop climbed down below the bank to the stone work upon which the body of the bridge rested in order to get out of the wind and regain his breath. Leaning against the iron work which sheltered him his breath formed little clouds as it struck the icy air. After a few minutes' respite he prepared to resume his patrol.

He was bending down to pick up his lanterns when suddenly a sound like the muffled report of a gun came to his ears. Then the iron-work of the bridge seemed almost to ring. It was as if someone had fired a heavy caliber gun towards the bridge and the bullet, striking its iron sides, had caused it to reverberate. Pop paused, his hand on the side of the bridge. Nothing further was to be heard except the rushing blasts of the wind. Climbing back up to the roadbed, he started back across the bridge to see if he could ascertain the cause of the report.

Less than four rods from where he had been standing he found it—a rail broken diagonally across and a piece of the ball nearly a foot long lying on the ties beside it. It was the worst break Pop had found thus far. It seemed as if some giant had grasped the steel line and by brute strength pulled it apart. When the rail broke it had given forth the report Pop had heard and caused the structure to fairly ring. He must immediately place signals to stop all trains and then notify Douglas, for this was a break which one man could not repair. As he turned quickly to go back and place the torpedoes his toe caught in the guard rail and he stumbled to the edge of the bridge. For a second he struggled to regain his balance, poised on the edge, but the force of the wind blowing against him made his efforts futile and with a last convulsive clutch in the air Old Pop went over the side, his lanterns thrown high in the air in his last desperate attempt to steady himself.

For a few minutes he lay quite still on the icy surface of the river, stunned by the force of the fall. Then struggling he raised himself up on his arms. The movement brought intense pain to his right leg and caused him to groan aloud as he allowed his body to sink back upon the ice. For a moment he could think of nothing but the awful pain. Then he tried to recall how it had happened—the muffled report, the reverating bridge, the broken rail, stumbling over the guard rail, the struggle to regain his balance, then down, down. Next came the thought of the two night passenger trains—No. 7 and No. 8, and No. 7 was due at Anchorville at 12:15 a. m. and No. 8 was due there at 1:17 a. m. Pop shuddered. He knew well that no train could ever pass over that rail with a piece of the ball broken out of it without being wrecked. And he, the guardian of their safety, lay almost helpless on the ice less than 60 ft. below the

break which he was to protect. If only he could notify the trains in some way! The very thought of dragging his bruised body up the 60-ft. embankment was sickening. It seemed hopeless. But there was no one else to do it. Upon him alone rested the safety of No. 7. He could at least try. Lifting himself up with one arm he felt in his pocket for the fusees. Two of them were still there. His lanterns were gone, where he did not know.

Setting his teeth, he placed both hands on the ice and then raised his body by doubling up his left knee. Very slowly and painfully he started for the river bank. For every foot of progress that he made he had to raise his body up from the ice with his left leg and then allow it to settle slowly forward, dragging his right leg behind him. Every movement caused his body to throb with pain—caused him to doubt if he ever could struggle up the embankment to the rails. But Pop tried not to think of the embankment. He tried instead to concentrate his thoughts on the next foot forward he would make. Little by little he pulled himself across the ice and the river bank until he was at the foot of the embankment leading up to the track. Here he paused, breathing heavily, for the effort to get there had been great. After a few minutes he pulled his silver watch from his pocket. Then he got a match from another pocket and struck it, sheltering it beneath his coat as it burst into flame. The flickering rays shone on the dial for a second before the wind caught it and extinguished it. It was 10:55. No. 7 was due in exactly one hour and 20 min. Slipping the watch back into his pocket Pop started on the most difficult part of his journey.

Running up diagonally along the side of the bank was a path that had been made by fishermen who walked out to the river on the track and descended to the bank at the bridge. Pop knew of this path and when he had started from the river had tried to make his way towards it as best he could in the driving snow and darkness. Luckily his sense of direction which he had acquired in the woods led him to it. It was not much of a path that stretched up the embankment ahead of him, but still without it to get to the top would have been an impossibility.

Now came the most disheartening part of his climb. If his progress across the ice and river bank had been slow and painful it was a hundredfold more so as he forced his way foot by foot up the steep sides of the hill. At times it seemed as if he just couldn't stand the pain when some sudden slip would throw his weight back upon his injured leg. But his iron will forced him on. He would make it. Many times he was compelled to stop for a minute and regain a little of his ebbing strength. But always he went on. In the end he had his way. Exhausted, he pulled himself up to the level roadbed and dropped upon the snow-covered ground where the icy wind swept over his weary pain-racked body with renewed fury in this exposed position.

When he had recuperated a little he lighted another match and again looked at his watch. Midnight! It had taken him over an hour to climb up the bank. No. 7 was due now in 15 min. The necessity for quick action impressed itself upon him. Crawling up to the rails he attached two torpedoes to them. That would protect No. 8 from the west, for in climbing up to the track Pop had also been climbing away from the broken rail, so that the torpedoes were some 12 rail lengths from it. Not far enough, he well knew, but as far as he was able to place them and protect No. 7, too. And No. 7 was due first. In less than 15 min. it would pass over the bridge if it was on time. To stop it he must crawl the 12 rail lengths to the bridge, then across it and some distance beyond if he could. For most men in Pop's condition the task would have been impossible. Not only did he have to struggle against his own physical defects and their pain, but he had to fight his way through the worst blizzard of the year.

For a few seconds he considered what it would mean if he should drag himself out on the bridge and No. 7 or an extra freight train should come along before he could reach the opposite side. If he were uninjured he might climb down upon the iron-work at one side and get out of harm's way, but with a broken leg, well—it meant almost certain death. But Old Pop did not hesitate. He knew that unless No. 7 was stopped before it passed over the broken rail that it was doomed. Slowly and painfully he resumed his efforts to reach the opposite side of the bridge. The torpedoes would protect him from behind after he had gone a short distance beyond them. He kept a sharp lookout ahead. Even with the air full of driving snow it seemed reasonable to think that he might see the big electric headlight of a train coming towards him before it was upon him.

Progress seemed a little easier now that he was again on level ground and he made the end of the bridge in less than 20 min. His right leg had been gradually growing numb and now he could not tell it was there except for the weight of it dragging behind him and the dull throbbing pain just above his knee. His hands were getting numb, too, although protected by his heavy mittens. Pop knew what that numbness meant. He had felt it once before when he was lost in a swamp up in the North woods and, becoming exhausted from walking, had laid down in the snow. That same numbness had stolen over his feet and hands then and only the timely arrival of a rescue party from the lumber camp had saved him.

At the end of the bridge he paused and listened. No. 7 was now 15 min. late. It seemed like suicide to venture out on the long stretch of narrow bridge barely wide enough for the single track on it. At any moment a train might come and grind him to pieces beneath its wheels. Or he might faint from the dull, throbbing pain in his leg and the cold, and lie senseless upon the track until the first train put him out of his agony.

These things again flashed through Pop's mind in the short minute that he listened before venturing out on his perilous trip. But with such heavy odds against him he did not flinch. His one life might save a hundred lives if he could do his duty. That it was his duty to stop all trains until the track was made safe, Pop never questioned. The fact that he was disabled did not change his duty any, he realized, and he would not excuse himself because of it. To Pop's way of thinking it was a gambler's chance. Could he reach the other side and stop No. 7 in time to save a wreck? Or would they catch him out on the bridge and grind his life out beneath their wheels? It was either one or the other.

Grimly he started out on the bridge, going just as rapidly as his battered body would let him—painfully slow at best. Foot by foot he crawled along between the guard rails, dragging his useless leg behind him. When he came to the break in the track he lighted a red fusee and stuck it in the ties beside it. This in case he could not reach the other side. It would burn for 10 min. Then he started on again. Ten minutes and he was well past the middle of the bridge. Three or four minutes more and, barring bad luck, he would be across. He paused to catch his breath, for even the slow pace that he made required a tremendous effort. Away in the distance, ever so faint, his ear caught the blast of a locomotive whistle. No. 7 was coming! In the same instant he realized that it was much nearer than the whistle indicated, for the wind was blowing the sound away from him. Frantically he resumed his efforts to reach the other side. If only he had the use of his legs for just one minute! It seemed hopeless to struggle—No. 7 would surely get there before he could ever make the remaining

distance. Yet he tried with all the desperation of a drowning man. A minute passed and he was only five or six rods from safety. But ahead of him was a lighter blur in the snow—the electric headlight of the engine on No. 7 seeking to penetrate the storm. Old Pop realized then that he had lost. The blur grew brighter and brighter and then the rays of the headlight shot through the driving snow. The train was less than half a mile away now. But Pop didn't forget. Tearing the last remaining fusee from his pocket he pulled the cap off and, grasping the cloth ribbon between his teeth, tore it from the top of the cap and quickly rubbed the exposed ignition surface across the end of the fusee. It broke into flame—a brilliant red light which tinted the snow with rose—and lifting it as high in the air as he could, he waved it across the track. Almost immediately two short blasts of No. 7's engine answered him—the engineer had caught the signal and was applying the emergency brakes. When the train came to a standstill the pilot of the engine was almost touching Pop's body as he lay senseless between the rails, the red fusee sputtering in the snow beside him where it had fallen from his hand.

* * * * *

Everybody on the C. G. R. & W. heard the story sooner or later. Such deeds travel far. Bert Douglas heard it the next morning and as he listened to the company doctor telling it, his eyes glistened and grew dim. But all he said was, "I always knew that you could depend upon Pop."

PREVENTING MOTOR CAR ACCIDENTS*

BY J. L. WALSH,
Superintendent of Safety, Missouri, Kansas & Texas Lines, Dallas, Tex.

THE INJURIES incident to the operation of hand and motor cars on the Missouri, Kansas & Texas Lines for the year 1918 numbered 275, or about 5 per cent of the total for the country. In classifying these fatal and non-fatal injuries the principal causes were found to be as follows:

Collisions: Train and motor cars	27	
Train and hand cars	16	
Motor cars	11	
Hand cars	4	
		58
Derailments: Motor cars	35	
Hand cars	9	
		44
Falling from motor cars	15	
Hand cars	18	
		33
Getting on and off motor cars	46	
Hand cars	2	
		48
Lifting motor cars	13	
Hand cars	32	
		45
Persons struck by motor cars	15	
Hand cars	24	
		39
Other causes		8
		275

Total motor car accidents	170
Total hand car accidents	105

The greater number of serious injuries were sustained in motor and hand car collisions and derailments; it will be noted there were 102 such accidents, injuring 37 per cent of the total. The great majority of all motor car accidents are caused by man failure; that is, the failure to comply with operating department rules, lack of ordinary care and good judgment in operating the car, or in operating a car that is in a defective condition, which could have been noted by proper inspection and have been corrected.

For general use a motor car should be as simple as possible, fool-proof and easy to operate and maintain. It should have a curved hand rail or guard extending to the floor in front of the car, and also a toe board, to prevent tools and material from bouncing off and derailing it. The wheels should not be more than 16 in. in height, and the floor of the car should be extended flush with the outer edge of the wheels to prevent men from getting their feet under the wheels in attempting to board the car from the side. Last but not least, each car should be fitted with a positive acting, effective hand brake, and if possible, a governor should be installed restricting the speed to 15 miles an hour.

The surest method of keeping hand and motor car accidents to a minimum after adopting a practical, properly-equipped car as standard and best suited for the purpose intended, is to promulgate a practical set of rules covering their inspection, maintenance and operation, and then see that they are strictly complied with. Some of the points that should be covered are as follows:

A member of the gang using the motor car, other than the foreman, should be assigned and trained to operate the car, thus leaving the foreman free for other duties. The foreman, of course, should be equipped with the current time table and standard watch.

Each man should be assigned a certain regular place on the car, overcrowding being avoided, and a sharp lookout being kept for trains, etc. Certain members should be charged with the duty of flagging, when necessary, and equipped with the usual flagging equipment.

The men charged with the responsibility of putting the car on the track and taking it off should be assigned to a regular position and instructed and drilled frequently in the most practical and safest manner of handling it.

Certain men should be assigned the duty of starting the car, the others taking their seats before it is started.

Instructions should be issued and the men trained to load tools and material on the car in such a way as to avoid the chance of it falling off and causing derailment.

Motor cars should not be operated at night except in cases of emergency, and then only when protected by a red light that can be seen from both directions.

Employees should be prohibited from standing on the car or attempting to mount or dismount while it is in motion.

If a truck or push car is to be attached it should be coupled close behind the motor car, and in starting the men should push from the rear of the truck or push car.

Motor cars should not be set off on a public highway, as serious injuries have occurred to drivers because of teams being frightened.

When necessary to apply brakes in an emergency, warning should be given if possible to all occupants of the car to prevent any chance of their being thrown off by a sudden slacking of the speed.

Motor cars should not follow a moving train closer than 1,000 ft., nor follow another motor or hand car closer than 500 ft.

The use of the motor car should be confined strictly to company business and it should not be taken off the section on which it is assigned except on instruction from superior officers, or in case of a storm or emergency making it necessary to file a report at the nearest telegraph office and secure instructions.

Motor and hand cars should be thoroughly inspected by the operator daily before starting to work and necessary repairs and adjustments made.

*Abstracted from a paper read before the Eighth Annual Safety Congress of the National Safety Council, at Cleveland, O., on October 4.

A Conclusive Record for Creosoted Piles

Thirty-Five Year Life in a Railroad Trestle Demonstrates the Unquestioned Value of Treatment

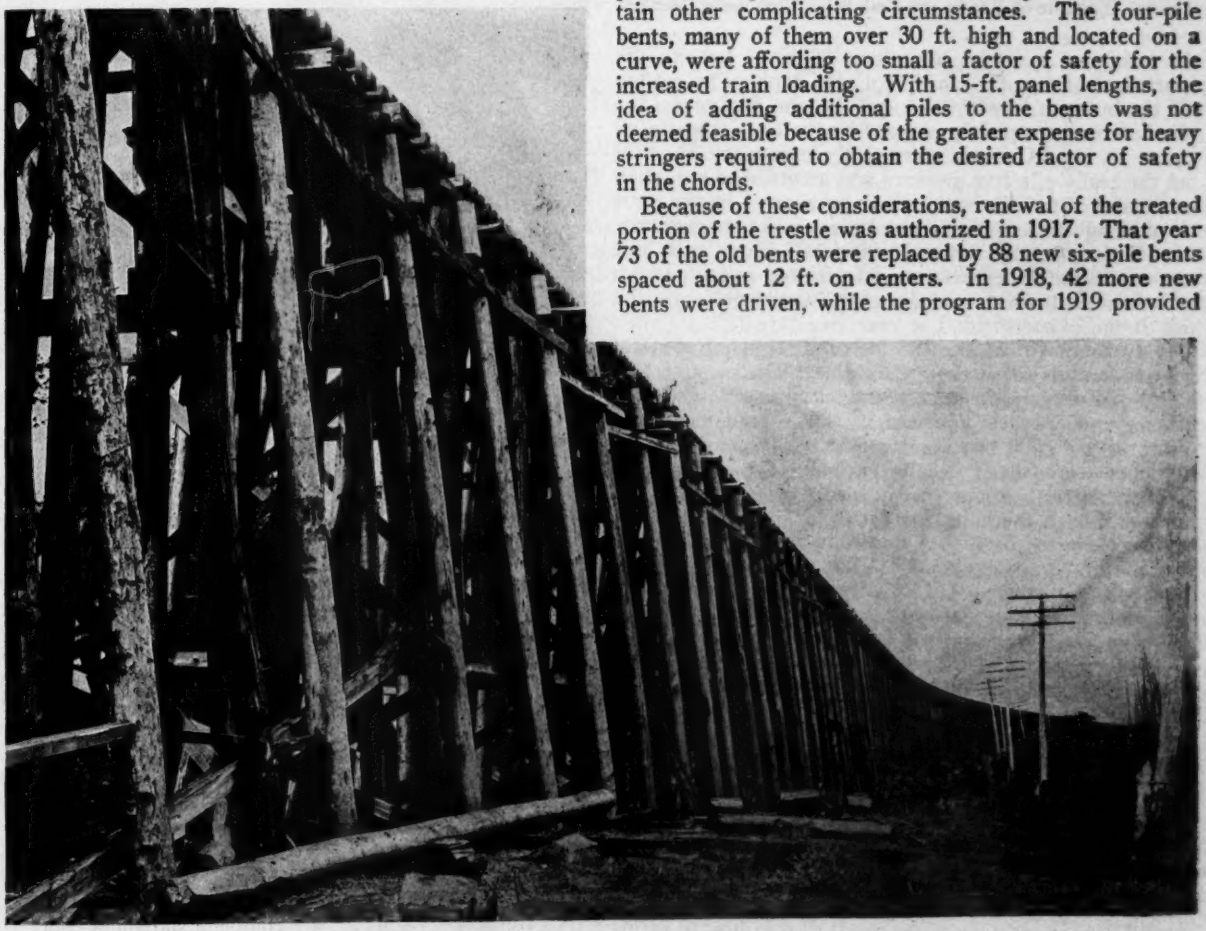
ONE OF THE BEST demonstrations of the value of treating wooden piles to resist decay has just been concluded in the renewal of a pile trestle after a useful life of fully 35 years. The structure in question is a three-mile approach on the Indiana end of the Louisville & Nashville bridge over the Ohio river at Henderson, Ky., of which 177 bents at the south end were built of creosoted, long-leaf, yellow pine piles. The record is particularly conclusive in this case, because the structure was under the care of one man during the entire service period. This man is A. B. McVay, supervisor of bridges and buildings for the Louisville & Nashville, with headquarters at Evansville, Ind.

Thirty-five years by no means represents the total average life of the piles, other considerations than the physical condition of the piles having called for the renewal of the structure at this time. As a matter of fact, only 15 per cent of the piles are now in a state of decay that would demand their replacement. Aside from the demonstration of the value of timber preservation afforded by this structure, a careful study of the piles removed also serves as an excellent lesson on the use of good material, thorough treatment and painstaking, high-grade workmanship.

The Henderson bridge trestle is about three miles long and all except 177 bents were driven with untreated timber. A large part of the structure is level, with bents from 14 to 18 ft. high, but for some distance near the river bridge, the grade rises on a 1.25 per cent grade, so that the height of the bents in the portion driven with treated timber runs to as much as 40 ft. Four-pile bents were used throughout, with panels 15 ft., center to center of bents, notwithstanding the fact that a considerable portion of this part of the trestle is on a 2-deg. 30-min. curve. The piles were treated in 1883 and driven in the spring and summer of 1884. Creosoted caps 10 in. by 14 in. in section were used, but the bracing and deck were of untreated timber. The piles were driven in typical river-bottom alluvial soil in a location normally above water level, but subject to overflow at times of high water in the river.

The deck was renewed in 1896, at which time the caps were replaced by cypress, while all of the untreated bracing was renewed in kind. In 1915, 12 of the original piles were replaced because of decay, and in 1917 it became apparent that about 15 per cent of the piles were in a condition that called for early removal. This consideration alone would not have justified any procedure other than piece-meal replacement of the defective piles, but for certain other complicating circumstances. The four-pile bents, many of them over 30 ft. high and located on a curve, were affording too small a factor of safety for the increased train loading. With 15-ft. panel lengths, the idea of adding additional piles to the bents was not deemed feasible because of the greater expense for heavy stringers required to obtain the desired factor of safety in the chords.

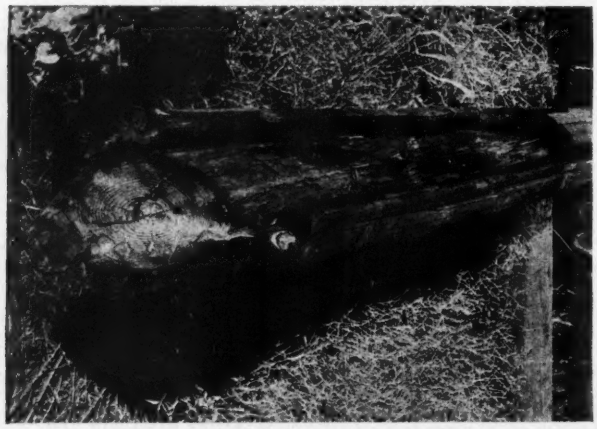
Because of these considerations, renewal of the treated portion of the trestle was authorized in 1917. That year 73 of the old bents were replaced by 88 new six-pile bents spaced about 12 ft. on centers. In 1918, 42 more new bents were driven, while the program for 1919 provided



View of a Part of the Henderson Bridge Trestle Showing New Pile Bents Driven Between the Old Ones

for the replacement of all the remaining original bents. A total of 221 new six-pile bents were required. Simultaneous with this work the existing open deck has been replaced by a timber ballast deck.

An examination of the old piles renewed shows that the treatment was excellent. They were creosoted at the Louisville & Nashville plant at Gautier, Miss., under the direction of the late J. W. Putnam, but no record of the exact nature of the treatment is available, although the depth of oil penetration would presume a heavy and extended period of steaming. Of the piles evidencing any decay, very few had decayed butts. This was, no doubt,



Typical Example of Rot in the Few Piles That were Decayed

the result of special precautions taken to protect the heartwood of the piles which had been exposed by cutting off the butts to receive the caps. In the first place, the pile butt was completely covered by the cap in nearly all cases. A cap 14 in. wide was partly responsible for this, but the really effective measure was an artificial reduction in the size of the pile butt (where necessary) by adzing it to an octagonal prism of about 14 in. on the short diameter. This was done *before* treatment. After each pile was cut off two holes were bored in the top and filled with hot creosote oil which was also coated thoroughly over the top of the pile.

Only about 10 per cent of the piles requiring renewal showed serious rot at the ground line. The most serious cause of decay arose from a practice pursued when the bracing timbers were renewed in 1896. In a misguided effort to get good bearing for the braces, many of the old piles were adzed deeply, exposing the less heavily treated material. Some decay also started around bolt holes, although the holes for fastening the original bracing were, for the most part, carefully plugged at the time that the bracing was changed. The characteristic rot at these places consists of a small opening leading into a cavity of appreciable size in the interior.

An interesting comparison is afforded in this structure by the fact that all of the trestle that was not constructed of the creosoted piles was driven with red cedar piles that gave a life of about 18 years. All renewals of these cedar piles were made with untreated pine piles that have since been renewed at least once, so that the creosoted piles have given more than twice the life of the untreated wood. The long life secured from these piles is clearly the results of the use of good timber, correct treatment and a careful regard for the detailed precautions necessary to insure a continuity of the shell of protected timber on the exterior of the pile. Eventual decay, where it occurred, was in most cases the result of a failure to secure absolute perfection in this regard. It is entirely clear that the small percentage of piles requiring renewal at the present time would be even smaller than it is but for the unfortunate cutting of the piles at the time that the braces were renewed.

OTHER EXAMPLES OF LONG LIFE

While there is probably no other single instance that shows an equally complete record, there are many other examples of long life for treated piles on the Louisville & Nashville, notably along the Gulf coast, where this road was the pioneer in the treatment with creosote in an effort to stop the destructive action of marine borers. While it has been found that treatment with creosote is not an absolute protection against this difficulty, although it is an unquestioned deterrent, the creosoted piles have demonstrated a most remarkable life in their resistance to decay from normal atmospheric influences.

The Louisville & Nashville has 10 structures over salt water between Mobile and New Orleans, where the teredo is more or less active. The borers are active in the waters of the Pascagoula river, Biloxi bay and Bay St. Louis, which are crossed by long creosoted pile trestles having drawbridges, and in one case fixed spans on pile piers.

The trestle at Bay St. Louis contained about 3,600 piles driven in 1879. At the present time 90 per cent of these piles are still in service, but, of course, protected against the teredo. In 1908, 60 new bents were driven in this trestle on account of settlement of the old bents, but

How the Piles Were Chamfered to Reduce the Diameter

none of the old piles were decayed. The trestle between Biloxi and Ocean Springs contains 1,200 piles driven in 1878. No record of these removals could be obtained, but the proportion of removals has not been greater than 10 per cent.

These two bridges originally had bents of four piles each, but in 1912 longer caps were put on top of the old caps and two piles, one on each end of the bent, were driven, to give greater bearing power for heavy traffic.

Because of a fire which destroyed a large portion of the records of the Louisville & Nashville, it is impossible to give a detailed record of all the piles in these structures. The following, however, is a complete statement concerning 5,093 piles in bridges between Mobile and New

Orleans driven in 1877 to 1879. After these piles had been in service some 12 or 14 years, examinations made below the water line indicated the need of some form of protection against further action by the teredo and other marine borers, as a consequence of which most of the piles have been incased in terra cotta or cast iron pipe filled with sand. This protection, however, has no bearing on the resistance of the pile to decay from atmospheric causes and as seen in the record below, 81 per cent of the piles are still in service:

Piles still in service unprotected against marine borers	617
Piles protected with pipe in 1892-93	3,513
Piles replaced in 1904, mostly because of storm damage	320
Piles replaced in 1906, mostly because of storm damage	112
Piles replaced from failure, decay and teredo—no date	95
Piles replaced in 1908 on account of settling	436

PERCENTAGES

Piles still in service unprotected against marine borers	12.1%
Piles still in service protected 1892-93	68.9%
Piles replaced in 1904	6.3%
Piles replaced in 1906	2.2%
Piles replaced—no date	1.9%
Piles replaced because of settling	8.6%
	100.0%

Some speculation is naturally raised as to possible influences favoring this long life. Salt spray from storms has been suggested as possibly coating the piles with a certain amount of salt which is known to have a certain degree of toxic value. On the other hand, these piles are located in a territory of very heavy rainfall, so that this protection would be washed off frequently, while the temperature is rarely cold enough to cause freezing, so that the climate is generally much more conducive to fungi propagation than in most all other parts of the United States.

A good grade of timber, thorough treatment and high-class workmanship in construction has had much to do with the success of these Gulf installations, as in the case of the Henderson bridge trestle. All of the piles were chamfered the same as at Henderson and the tops were thoroughly coated after cutting them off for caps, while galvanized iron has been used extensively to protect all horizontal surfaces against the collection of rain water.

Decay that Took Place After the Piles had been Dipped

Improving the Quality of Steel Rails*

By ROBERT W. HUNT
President, Robert W. Hunt & Co., Chicago

FROM THE EARLIEST consideration of the subject, the value of proper inspection has always been recognized, and some of the most important points of discussion have been as to how that inspection should be conducted.

This led the writer, early in 1912, to recommend to his clients a more detailed system of inspection than had until then been used, which should more thoroughly supervise the progressive steps in the manufacture of the rails; beginning at the making of the steel down through the various stages of manufacture to the loading of the finished rails upon the cars for shipment. On this line, the firm of Robert W. Hunt & Co. at the request of one and with the approval of several others of its more important patrons, established in 1912 what is known as its "Special Inspection."

The result of this special system of inspection has been most satisfactory to both the manufacturers and the purchasers, and it receives the approbation of the workmen themselves, as each man knows that if he properly performs his duties he is protected against the danger of being held responsible for the acts of a less careful operative, while the mill management has given it, without cost, a thorough system of supervision. That it has proved satisfactory to the railway companies who have been employing it is best evidenced by the following, gathered from the records of the American Railway Engineering Association.

The statistics covering open-hearth steel rails give the failures that have occurred in five years, ending October 31, 1917, on 37,862 miles of track. Forty-five per cent of this mileage comprised rails rolled under special inspection, and therefore 55 per cent was made under other conditions. The total number of failures per 100 track miles on all of the mileage reported was 31.1, while the number of failures per 100 track miles on the rails covered by special inspection was 26.6, and the number of failures per 100 track miles of those not covered by special inspection was 34.8. Thus, there was 30 per cent in favor of specially inspected rails.

As each ingot is a separate and individual casting, I believe that, in addition to the tests representing the whole heat of metal, there should be some way of determining the physical character of the steel rolled from each and every ingot. As a destructive test seems to be the only way actually to ascertain that point, and as, of course, you cannot destroy all the rails, I, in 1915, installed what is known as the nick-and-break test, under which a test piece is cut from the top end of the first, or *A*, rail rolled from each ingot. This is nicked and broken, thus enabling the inspector to examine the fractures and, in case of the presence of segregation, pipe, or some other mechanical defect, to reject the rail represented by the test piece. Following such rejection, a test piece shall be cut from the bottom end of the same rail and broken; if that piece has similar defects, the second, or *B*, rail is rejected, and a piece cut from its lower end, and tested. In case of failure, the procedure is continued for the succeeding rails until a sound one has been reached. This has proved an

*A paper presented before the American Institute of Mining Engineers at a recent meeting in Chicago.

expeditious and cheap procedure, and in my judgment very satisfactory.

As the chemical composition of the steel is a fundamental part of rail specifications, a very important point is the taking, for analysis, of the drillings representing the heats of steel from which the rails are rolled. The drillings must be taken from test ingots, and the time and manner of casting these ingots, as well as their shape, is receiving attention. In fact, the whole matter of ladle-test ingots is now receiving the attention and study of a committee of the American Society for Testing Materials in conjunction with the U. S. Bureau of Standards.

A few years ago there were many rail failures through what were designated as crescent-shaped breakages; that is, ruptures in the rail flanges extending from the outside inward toward the web, the broken pieces being of crescent shape. These fractures were frequently followed by complete cross-fractures of the rails, resulting in many costly and oftentimes fatal accidents. It was found that, as an almost inevitable rule, there was a longitudinal seam in the bottom of the rail flange at the point of fracture, which was directly under the web of the rail. This situation caused great anxiety and led to much discussion as to the causes of the seams or laps. One steel company developed and established a de-seaming adjunct to its rail mill, by which the outer steel of that part of the blooms subsequently forming the heads and flanges of the rails was milled off. The works claim success from the scheme. The later adopted sections have thicker flanges and the crescent-shaped breaking trouble seemed to have become minimized; but I regret to say that during the past year one of the prominent railway systems has been having a large number of such failures from heavy rails. Another system encountered the same kind of defects, which, in this case, fortunately were discovered before serious damage occurred. The rails were from different steel companies; therefore, it is again a matter demanding prompt and effective action. To require all producers to establish de-seaming mills is very radical, but if that is the only way property and life can be protected from such danger it may have to be done.

Another point of less importance, but still of prime necessity, is the milling of both ends of the rails. This has been the practice of English mills for years and some American makers mill one end of some of the rails made by them. To depend on chipping and filing for the finishing of the ends of the rails is very unsatisfactory. Milling would not only eliminate all fins resulting from the hot sawing, but positively assure squareness of ends and accuracy of lengths, all three of which are of great importance in relation to joints, a part of track maintenance that is receiving more and more attention.

Much thought and considerable experiment have been given to the betterment of the cold straightening of rails. From the time of that procedure being represented by the blows of a heavy sledge swung by a sturdy man, the practice has been a brutal one. To accomplish the semblance of the desired result, the steel has to be bent beyond its elastic limit, thus enabling strains with an ever-present danger of causing actual or incipient ruptures in the metal, which may result in complete rail failures. In my judgment, it is practical to do away with cold straightening, by proper hot straightening of the rails. If, in case of uncontrollable conditions, a few rails should come from the hot beds unsuitable for use, they could, after some cold straightening, be classed as seconds and used for other than main-track purposes.

In the present practice a rail is put under the cold press and most carefully, but brutally, punched into seeming straight line and surface. Frequently it is later put on the ties and with equal care spiked out of a straight line into curves of varying degrees. Rails can be hot straightened without any short kinks and with lines that will permit good loading for transportation and satisfactory track layage; thus can the expense and danger of the cold-straightening be avoided. There are now at least a thousand tons of rails, finished as above advocated, giving satisfactory service in the lines of several railroads having heavy traffic, and they have had over three years of trial.

To secure sound rails it is of supreme importance to make sound ingots. Sir Robert Hadfield presented a paper before the Iron and Steel Institute in October, 1912, which attracted wide attention and much discussion. The plan is broadly designated as using a "hot-top ingot," but as yet hot-top ingots are not used in rail making; both encouraging and disappointing experiments have been made, but I am satisfied that this method is practical and will be so proved. Based on the results obtained with other than rail ingots, its success with them is bound to come. Therefore, while I am not at this time prepared to incorporate hot-top ingots in rail specifications, the time is near when it will be entirely practical to do so.

The most harmful physical characteristic of rail steel is, of course, brittleness. The low amount of phosphorus present in open-hearth steel renders protection against the dangers from that element and permits freer use of carbon as a hardening element. Experience has pretty well demonstrated that the safe upper limit for carbon in rail steel is approximately 0.75 per cent; and accepted practice has allowed a working range of 13 points, with the result that the lower limit of carbon has been most frequently specified as 0.59 per cent, but in some cases 0.62 or 0.63 per cent; speaking, of course, of the almost universally accepted practice of having the steel contain not over 0.04 per cent phosphorus. The problem of always making basic open-hearth steel within this range is difficult and frequently heats are cast slightly outside the limits specified. There is a much greater commercial opportunity for manufacturers to find other than rail uses for steel containing the lower amounts of carbon than when containing the higher amounts; therefore, they naturally aim to have the carbon content nearer the low side of the permitted range. Hence, the larger percentage of heats is on the low side of the allowed carbon.

The various railway systems of the country are now using as their standard practice about the same weight of rails. There are some variations of sections, but I do not see any serious objection to the adoption of a general or common chemical specification. We know that hundredths of percentages are very delicate variations and, especially in relation to carbon, errors may occur in the results obtained by two different chemists, particularly if working under modern manufacturing pressure. If a common carbon, silicon, manganese and phosphorus specification prevailed, the work of the open-hearth steel melter would be simplified, the cold-ingot trouble eliminated, and, I think, better general results obtained.

As a means of lessening the tendency on the part of the manufacturers to protect themselves by keeping the carbon content of the metal toward the lower range, it would be well to accept not over an agreed upon small per cent of heats slightly higher in carbon than the specifications. These rails could be specially marked and shipped, so that the roads would have them by themselves and use them in places for which they would be well adapted.

Another development of great interest is the triplex processes, both on the Bessemer open-hearth electric and the Bessemer and double open-hearth plans. These are being workd out in practice and, I believe, will soon be adding much toward the production of more regular and, hence, better steel, and, of course, also better rails.

THE TREATMENT OF WATER FOR LOCOMOTIVES*

This Important Phase of Railway Maintenance Work Must Be Handled in a Broad and Thorough Manner

BY WILLIAM M. BARR,
Consulting Chemist, Union Pacific, Omaha, Neb.

WATER SUPPLY was merely an incident in railway operation only a few years ago. The nearest ample supply of water, regardless of quality, was developed for use in locomotives. It was many years before railway officers came to realize fully that some of these waters which were easily obtained in ample quantity were costing the railroads large sums of money. It is hardly necessary here for me to point out the various conditions resulting from the use of bad waters that made the use of these waters expensive.

I have noted that the American Railway Engineering Association has tried to reduce the saving to figures showing that every pound of scale forming ingredients removed from any water results in a saving of 7 cents. This has been recalculated to meet present price and wage conditions and has been given as 11 cents. My personal belief is that no matter how competent the men may be who have collected the data and reduced the saving to cents per pound, the figures at which they have arrived can only be an approximation. It is safe to assume, however, that the figure given is small enough as the error usually results from the omission of savings that cannot be reduced to figures. There are so many factors that enter into the saving to be accomplished, some of which cannot be accurately calculated, that it becomes practically impossible to say that a certain definite treatment will save a fixed number of dollars. We, therefore, must content ourselves in a discussion of the treatment of water for locomotives by making the assumption that in general all improved water conditions are profitable to the railroad.

In attacking the railroad water problem one must lay down as a fundamental principle that the primary object of the railroad is to move tonnage and that everything that interferes with such movement is bad practice. We may, for example, take one of the worst waters that can be found and so treat it that the amount of scale forming solids it contains will be almost negligible, but an engine taking this water might fail before it had covered one-half of its run. It would immediately be concluded by both the operating and mechanical departments that the water treatment, whatever it might be, was wrong, and these departments would be justified in such conclusions.

A water at one station contained 123 grains of dissolved solids per gallon. Other stations on the same district were high in sodium salts. Had this water been treated to remove the incrusting solids, the sodium salts in the treated water would have been approximately 90 grains per gallon. This would have been certain to cause engine failures from foaming. A new supply containing 35 grains of dissolved solids per gallon was obtained at this point and treatment of this water gave good results.

I have frequently said that the first thing to be done on any railroad is to make a thorough survey to determine how many good waters can be developed within a reasonable distance from the line. This seems like a very simple statement and it may be said that this is what anyone would do. I will, however, venture the further statement that there are few railroads in this country where thorough field work and a careful study will not develop some good water supplies that have heretofore either been overlooked or ignored.

At a station in the arid region of the southwest the water supply for both town and railroad is brought in by pipe line from springs, a distance of two and a half miles. Later geological studies and deep borings show that a deep well at the tank would give an ample supply of soft water which would flow into the tank.

What constitutes a reasonable distance to go from the line for a water supply depends upon the amount of water required at the station to be considered, the character of other water supplies on the district, and the character and quality of water that may be already available at the station. I take the position that in order to avoid a water treatment of any kind the railroad can afford an expenditure entirely out of proportion to the actual cost of water by treatment at the station. The cost of water should not be figured in cents per thousand gallons at a single station, but should be figured as an average cost over the division or, if you please, over the entire line. When all available good supplies have been developed on a district or division it is then time to determine the best method for improving such supplies as may not be satisfactory.

THE USE OF BOILER COMPOUNDS

Many statements have been made to the effect that water should not be treated within the boiler. It is my judgment that the intelligent and rational use of a properly made boiler compound is frequently beneficial. There will probably always be some places on any railroad where compound may be used with benefit. Naturally I prefer to control the composition of any compound used under my direction, as this enables one to judge results more accurately and to modify treatment so as to improve results that may not be satisfactory.

In using boiler compound enough chemicals are added to form a soft and somewhat flocculent precipitate. Thus when the other scale forming substances in the water are thrown out by heat, this precipitate already formed will carry down the bulk of scale in the form of a soft sludge, preventing it from building upon the flues and keeping it in a condition to be discharged from the boiler by means of the blow off. The natural result to be expected would be a more frequent washing of boilers. However, this sludge is more easily washed out and any scale that does adhere to the flues is more easily removed than would be the case with the untreated water.

There are many districts where the waters carry a light scale which would not justify a line of treating plants. The use of a compound here would keep the scale soft and with the use of the blow-off would result in improved boiler efficiency and less shop work.

WATER SOFTENING

For a long time the problem of water softening was generally considered to be a treatment of a water outside the boiler, which removed by chemical precipitation the scale forming solids held in solution in natural wa-

*Abstract from a paper read before the Western Railway Club, Chicago, on November 17, 1919.

ters. Those who have studied this problem, both in connection with stationary boilers and locomotives, have come to the concluson that the problem is much deeper than the mere removal of boiler scale.

In treating water it is important to consider not only the amount of scale to be removed, but other properties of the softened water, which may or may not result from the process of removing the scale forming constituents. One author has very aptly stated the case by saying, "A modern boiler is not merely a basin in which liquid water is converted into gas but a receptacle for the mineral impurities contained, in greater or less quantities, in all natural waters even when softened. The boiler is in reality an autoclave in which chemical solutions are concentrated and partially evaporated at high temperatures and pressure, and should be looked upon as a chemical factory in which various chemicals are produced during the conversion of ordinary water from initial temperatures, of, say 60 deg. F. into steam, often highly superheated."

It would be an ideal situation if we could put nothing but pure water into a boiler, but in practice this is a condition which it is rarely possible to obtain. We must, therefore, study the chemical reactions which take place in the boiler under pressures and temperatures which are not normally found when studying similar reactions in the laboratory.

In the operation of water softeners there are three conditions that are essential to the success of the treatment: (1) Ample settling space, (2) thorough agitation, (3) careful supervision. Attempts have been made in the construction of many water softeners to limit the capacity in an effort to reduce the initial cost of equipment. This is a common and serious error, in the first place because it allows no margin to provide for the expansion of business, and secondly because the original time allowed is frequently too small at the start. In addition to allowing five hours' reaction time it is good practice to make provision for a reasonable increase of business, which American railway operation has shown to be almost certain on the majority of our transportation lines.

The necessity for agitation is sometimes overlooked in water treatment on the assumption that, if the chemical mixture is uniformly distributed throughout the entire volume of water treated, reaction must take place and no mixing beyond this point is required. Even though thorough agitation is accomplished and ample settling time allowed, I believe it is always desirable to provide filtration for the treated water, if for no other reason, as a safeguard to the removal of any suspended matter that might get through.

The supervision of water softeners has frequently been a weak spot, not only in railway operation, but in the general operation of treating plants. As a rule, the men directly responsible for the operation of the machines are non-technical men and there is a lack of appreciation of the requirements or the performance of these machines. It is, therefore, essential that frequent checking of the treatment by analysis, as well as frequent inspection of the machines should be made. To get the best results in this particular it is important that a spirit of co-operation be developed between the chemical staff and the department operating the water softeners. Much depends upon the personality of the men who make the inspections and give instructions to pumpers for the handling of the chemical treatment.

My own practice requires that daily reports be made by the pumper showing: The exact time of operation; the time and amount of each chemical charge; the time of dumping sludge; appearance of water when it leaves the machine; condition of all mechanical parts; amount of chemicals on hand; in case of surface waters, a test on both raw and treated waters showing hardness, alkalinity and causticity; and repairs needed.

A copy of this report is sent to the water service foreman as well as to my own office. Pumpers are also instructed to make telegraphic report of any unusual conditions which may arise. Machines are inspected and water tested by traveling chemists on an average of once in 10 days, and weekly samples are sent to the chemical laboratory for analysis.

In addition to this inspection, men experienced in the use of water in locomotives as well as water treatment make occasional trips with traveling engineers or with the engine men alone, in order to determine whether or not good results are being obtained in the operation of locomotives under existing water conditions. These men also visit round houses and shops, examine flues and fire boxes, conferring freely with foremen and the general boiler inspector.

The work of such men has to do not only with treated waters, but with general water conditions and use of boiler compounds. If traveling engineers report trouble of any kind arising from the water supply the master mechanic reports promptly to my office and to the superintendent of motive power. One of these men is sent to work with the traveling engineer in order to determine the source of the trouble and correct the condition causing the complaint.

FOAMING

Foaming is to the engineer one of the most serious troubles that arises from the use of water, and as this interferes seriously with traffic, it is important that efforts be made to reduce this condition to a minimum. There seems to be some difference of opinion as to the primary cause of foaming. I note that the American Railway Engineering Association has revised the manual to read, "This action is due primarily to the presence of suspended matter in the water. The suspended matter gives a mechanical strength or tenacity to the liquid in the thin films over the steam bubbles, which, rising to the surface, retain their films and collect to produce foam. It is aggravated by the concentration of alkali salts present in the natural waters or added by the process of water softening, which increases the viscosity of the surface films.

I cannot agree with the statement that foaming is primarily due to the presence of suspended matter. If a water is pure insoluble, suspended matter will not increase the viscosity of the surface film, and will not in itself produce foaming. On the other hand, dissolved solids may be increased to such a point that foaming will result without the presence or assistance of suspended matter. It is true that this condition is greatly aggravated by the presence of suspended matter, and foaming in muddy water or dirty boilers takes place most easily. I would say that foaming is due primarily to the presence of any matter in solution which sufficiently increases the viscosity of the surface film in the boiler and is greatly aggravated by the presence of suspended matter.

In locomotive operation it is difficult to separate the two conditions. All locomotive boilers contain suspended matter in varying amount, therefore, as the dissolved solids are increased by concentration there will be a tendency to foam.

I have under my jurisdiction a district that receives perfectly clear water at all stations. These waters are either filtered or come from deep wells which furnish clear water. About the middle of this district there is a water supply that is high in sodium salts, carrying a rather large amount of sodium carbonate. It is necessary for all engines running on this district to carry a supply

of anti-foam compound, which is usually applied when this water is taken. The concentration is also relieved by frequent use of the blow-off. By such means engine failures from foaming are prevented or reduced to a minimum.

As an overtreated water has a tendency to increase foaming troubles it is necessary, particularly on districts where the waters contain excessive amounts of sodium salts, to hold the treatment below the point of excess alkalinity.

BOILER WASHING

Water treatment bears such a close relation to boiler washing that some consideration should be given here to this subject. It is frequently recommended that anything should be done that is possible to increase the time between washouts. If this can be done by increasing the purity of the water, the extension of such time within reasonable limits is desirable and profitable. I do not believe, however, that this time should be extended to the limit by artificial means simply because it is possible to keep an engine moving without failure. By doing this the cost of an occasional washout may be saved, but one failure resulting from this policy will compensate for the cost of several boiler washings.

In calculating the saving effected by extending the time between washouts the increased efficiency in operation with clean boilers resulting by the more frequent washouts, is often overlooked, though it is sufficient to deserve consideration. The more frequent washout usually results in a reduction of boiler work as opposed to the extension of the washout period at the expense of dirty boilers.

CORROSION

Much has been written on the subject of corrosion in boilers and various theories have been proposed to account for it. It still remains the most difficult feature of water treatment for locomotive boilers. The electrolytic theory offers a reasonable explanation for much of the corrosion which takes place, particularly cases of pitting and corrosion around stay bolts. It is beyond question that a segregation of impurities in steel will result in such spots having a different electric potential from that of the main portion of the steel, and in many waters which are good electrolytes, would set up galvanic action and start corrosion.

There are, however, corrosive conditions existing in the use of many waters where the action can be explained by reactions that are purely chemical. Owing to the fact that steel is not a homogeneous material there are spots where the metal contains impurities that are attacked first and will corrode more readily than the uniform portion of the metal.

Carbonic acid, either free or combined, is one of the potent factors in accomplishing corrosion in most boilers. It is present in practically all natural waters and being quite soluble, particularly in the cold, it enters the boiler in nearly all feed waters. Waters containing magnesium sulphate and sodium chloride give the same corrosive properties. All of the nitrates found in natural waters behave in the same manner and when the concentration is sufficient are very corrosive. The nitrates are especially active because in the process of corrosion the original nitrate is regenerated or converted to nitrate. While the nitrates and chlorides can be converted to their sodium salts by treatment and by carrying an excess of alkalinity the corrosive effect reduced, experience shows that waters containing high chlorides or nitrates are unsatisfactory on account of their corrosive properties even when treated.

Enough has been said here to give some idea of the range of the problem of water treatment for locomotives. It has been pointed out that the water should be studied from the source of supply to the engine washout. One man should follow these problems from beginning to end and should not at any stage turn them over to be handled by another person or department. I believe that the greatest success can only be obtained in railroad water treatment when the responsibility for the entire problem is centered in a single department. This might be accomplished by handling the problem in one of the existing departments of normal railway operation, but this does not seem to me to be advisable.

PROTECTION OF WOODEN BRIDGES FROM FIRE*

THE PROTECTION of wooden bridges and trestles from fire necessarily resolves itself into two sections: (1) The prevention of the fire, and (2) the extinguishing of the blaze should it pass the first barrier.

Under the first section, that of fire prevention, the first question that arises is: What are the causes of these fires, and statistics tells us that 90 per cent of them are caused by locomotive sparks, either from the smokestack or the ash pan, the remainder being lightning, incendiarism or causes unknown. The remedy lies, in the opinion of this committee, in the following preventive measures:

(1) That effective spark screens be provided in the front end of all locomotives and carefully maintained.

(2) That ash pans and grates be made tight and kept in good working order, as the dropping of hot coals or ashes is a source of a large amount of our trouble.

(3) That special places be provided for the dumping of cinders and ashes, and grates are not to be shaken down except at safe points.

(4) That all combustible refuse, such as dry leaves, dead grass, weeds, brush and rubbish, be cleared away from under and around all wooden bridges.

(5) That the decks of all wooden bridges, between the rails, be covered with No. 22 galvanized iron, this to prevent sparks from setting fire to the structure should they be dropped from the locomotive.

(6) As a further preventive measure, it is recommended that all wooden bridges be coated with a fireproof or fire-retardent paint, demonstration having proven some of them to be of excellent protection, and that they can be applied at a cost no greater than that of ordinary paint.

Under the second section—that of extinguishing the blaze after the fire has started—our efforts are limited to putting out the fire in its incipiency, for the reason that after the blaze has gained some headway, nothing less than a complete fire equipment would be able to subdue it. It is therefore recommended:

(1) That one water barrel and one pail be provided for all wooden bridges of a length of 50 ft. or less, and two water barrels and two pails, one to each barrel, be provided for all bridges whose length is more than 50 ft. up to a length of 150 ft., and that one water barrel and one pail be provided for each additional 150 ft.

(2) That where a bridge requires one or two barrels and pails the same are to be placed at the ends of the bridge, located at proper clearance from the track and buried in the ground to within six inches of the top, and where barrels and pails are located in the middle of the bridge they are to be located at proper clearance from the rails and the top of the barrel is to be provided with a wooden or galvanized iron cover.

(3) In the past great difficulty has been experienced

*From a report submitted before the annual convention of the Railway Fire Protection Association at Chicago, November 18-20.

in keeping pails intact with the water barrels, especially where galvanized iron pails or fire buckets have been used, and they are invariably missing when wanted, and it is therefore recommended that a square wooden bucket of unfinished lumber be provided and that the same be suspended in the water inside of the barrel.

(4) As a further means of extinguishing the blaze, it is recommended that all locomotives be equipped with fire-fighting apparatus so that they may cope with the situation should occasion arise.

It is to be regretted that, of the 20,628 fires that were reported on the railroads under government control in 1918 that resulted in a loss of $12,250,000, most of the fire losses occurred through carelessness, indifference or lack of proper precaution and a large majority were readily preventable. It devolves upon us to see that rules, regulations and instructions are carefully adhered to and that everyone exercises the greatest care and exerts his very best efforts in reducing this large and unnecessary fire waste.

RULES FOR THE PREVENTION OF THE SPREAD OF FOREST AND FIELD FIRES*

PRECAUTIONARY MEASURES.—1. Railroads shall not permit fires, burning waste, live coals, ashes, wood or other substances in a burning state to be deposited on tracks or right-of-way, unless such fires are completely extinguished immediately thereafter; except where such fires are deposited in pits provided for that purpose, or deposited on parts of track specially designated as being safe for such purpose.

2. Railroads shall take the necessary measures to maintain tracks and right-of-way in safe condition to prevent the spread of forest, prairie and field fires.

Preventive measures shall be taken in all cases where coal or wood burning locomotives are operated through districts where there is possibility of fire running. In general, such measures shall be as follows:

DISPOSAL OF INFLAMMABLE MATERIAL.—(a) All inflammable material, such as standing dead trees, logs, dead or decayed wood, brush, dry leaves and dry grass, within the limits of the right-of-way, shall be burned off early in the spring months, and as often thereafter as may be deemed necessary.

SUPERVISION OF BURNING OPERATIONS.—3. No railroad, through its agents, employees or contractors, shall burn, or cause to be burned, any cross or switch ties, mowings, debris or other litter on or near the right-of-way except under proper supervision, to prevent such fires from spreading beyond control. During the period of greatest fire danger, no such burning shall be done by the railroad forces.

REPORTING FIRES.—4. Railroads shall instruct and require stationmen and other employees, agents or contractors to report fires and extinguish same when on or adjacent to the right-of-way, as follows:

(a) Enginemen, conductors or trainmen who discover or receive notice of a fire burning upon or adjacent to the right-of-way, or of a fire which threatens land or property located adjacent to the right-of-way, shall report its existence and exact location by milepost to the agent or person in charge at the nearest point where communication by telegraph or telephone is available, and also notify the first section employees passed. Notice of such fire shall also be given immediately by enginemen by a system of warning whistles.

(b) The agent or other employee of the railroad shall at once notify the nearest section employees, and, if possible, the nearest federal or state forest fire official, of the existence and exact location by milepost of such fire.

(c) When a fire is reported or discovered burning adjacent to the right-of-way of a railroad, regardless of its origin, such sectionmen or other employees of the railroad as are available shall at once proceed to the location of the fire and extinguish it, provided such sectionmen or other employees at the time are not engaged in work essential to the safe operation of trains.

(d) Railroads operating through forest districts shall provide suitable blank forms for reporting fires occurring on or adjacent to the railroad right-of-way, regardless of their origin. Section foremen shall be instructed and required to make detailed written report on the prescribed form of any fire, however trivial, and to forward such reports promptly to their superior. The intent of this rule is to determine and, if possible, to eliminate the causes of fire.

SPECIAL INSTRUCTIONS.—5. Railroads shall issue special instructions to employees concerning the foregoing rules or regulations. Such rules or regulations shall be posted on bulletin boards at round houses, section houses, stations, and in conspicuous places on other parts of the right-of-way of the railroad.

CO-OPERATION WITH OTHER AGENCIES.—6. In view of the aid that may be rendered by the various state forest fire protective organizations, the officers of the Forest Service of the United States Department of Agriculture, and timber owners' protective organizations, the closest possible co-operation by railroads with such agencies, wherever they exist, is desired and encouraged. The details of such co-operation between the railroad forces and the protective organizations is to be arrived at by mutual agreement between the parties concerned.

MINIMUM REQUIREMENTS.—7. The foregoing rules or regulations constitute minimum requirements. It is not intended that they shall supersede state laws or regulations where additional measures are in effect, but they are supplementary thereto.

*Exhibit L, Recommended Rules, Report of Section II—Engineering, American Railroad Association.

RELATIVE DURABILITY OF GREEN AND SEASONED TIMBER

WHILE OPINIONS have always differed as to the comparative durability of untreated green and seasoned timbers when used for poles, posts and ties, recent experiments by the Forest Products Laboratory, Madison, Wis., indicate that there is practically no difference in their period of life when exposed to the weather and in contact with the ground.

A test of untreated green and seasoned ties made of Douglas fir and western larch in co-operation with the Northern Pacific and at two different points showed that the life of the green fir ties was on an average 7.65 yr., while that of the seasoned was 7.75, a difference of 0.10 yr. in favor of the seasoned. In the case of the larch, the results were about the same, the green ties lasting an average of 7.3 yr. and the seasoned 7.4 yr. Tests of telephone poles showed the rate of decay in green poles to be a trifle less than in the seasoned.

This almost equal durability of untreated green and seasoned poles and ties or, in fact, any exposed timber in this condition, is due to the fact that as soon as it is placed it begins to take up or give up moisture according to its condition of seasoning and the conditions of exposure. Thus in a relatively short time both green and seasoned timber reach the same moisture content and as this is the determining factor in decay, their life will necessarily be approximately equal. This does not apply, however, to wood used in building construction, as it does not usually dry out so rapidly after being placed.

ACTIVITIES OF THE RAILROAD ADMINISTRATION

President Wilson Orders Return of the Roads on March 1, 1920

Cummins and Esch Railroad Bills Now in Conference

Washington, D. C.

PRESIDENT WILSON'S long expected indication of his decision as to the ultimate disposal of the railroads materialized on Christmas eve, when he issued a proclamation returning the roads to their owners on March 1, 1920. The proclamation read as follows:

"Whereas, in the exercise of authority committed to me by law, I have heretofore, through the secretary of war, taken possession of, and have, through the director general of railroads, exercised control over, certain railroads, systems of transportation and property appurtenant thereto or connected therewith, including systems of coastwise and inland transportation engaged in general transportation and owned or controlled by said railroads or systems of transportation; including also terminals, terminal companies and terminal associations, sleeping and parlor cars, private cars and private car lines, elevators, warehouses, telegraph and telephone lines, and all other equipment and appurtenances commonly used upon or operated as a part of such railroads and systems of transportation.

"And, whereas, I now deem it needful and desirable that all railroads, systems of transportation and property now under such federal control be relinquished therefrom.

"Now, therefore, under authority of Section 14 of the federal control act approved March 21, 1918, and of all other powers and provisions of law thereto me enabling, I, Woodrow Wilson, president of the United States, do hereby relinquish from federal control, effective the first day of March, 1920, at 12:01 o'clock a. m., all railroads, systems of transportation and property, of whatever kind, taken or held under such federal control and not heretofore relinquished, and restore the same to the possession and control of their respective owners.

"Walker D. Hines, director general of railroads, or his successor in office, is hereby authorized and directed, through such agents and agencies as he may determine, in any manner not inconsistent with the provisions of said act of March 21, 1918, to adjust, settle and close all matters, including the making of agreements for compensation, and all questions and disputes of whatsoever nature arising out of or incident to federal control, until otherwise provided by proclamation of the president or by act of congress; and generally to do and perform, as fully in all respects as the president is authorized to do, all and singular the acts and things necessary or proper in order to carry into effect this proclamation and the relinquishment of said railroads, systems of transportation and property.

"For the purposes of accounting, and for all other purposes, this proclamation shall become effective on the 1st day of March, 1920, at 12:01 a. m."

A similar proclamation issued by the president releases the American Express Company from government control on the same date.

On December 24, Walker D. Hines, director general of railroads, sent the following message to all officers and employees of railroads in federal control, through the regional directors:

"The proclamation which the President has issued fixes March first as the date for transfer of the railroads back to the possession and control of the railroad companies. I appeal to every officer and every employee to redouble his efforts to produce the best and most economical railroad service possible during the remaining period of federal control. During the unusually heavy business of the past few months and the extraordinary difficulties created by the coal strike the officers and employees have done especially fine work, so that with more confidence than ever before I express the hope that all of us will give the very best account of ourselves in this remaining period in our common interest and in the public interest. I extend to all of my comrades in the railroad service and their families my sincere wishes for a Merry Christmas and a Happy New Year."

The Senate on December 20 passed the Cummins bill, which provides for the return of the railroads to private management at the end of the month in which it becomes a law by a vote of 46 to 30, after about three weeks of debate, in which but few senators displayed much interest and which resulted in very few changes in the bill. The most important change was the adoption of an amendment proposed by Senator Frelinghuysen of New Jersey creating a revolving fund of $500,000,000 from which loans could be made to railroads for capital im-

A Proclamation

My predominent wish for 1920 regarding public affairs is that prior to the the termination of federal control there shall be adequate railroad legislation which will be a sufficiently radical departure from the unsatisfactory railroad status prior to federal control as to insure the continued development of railroad transportation in the public interest and the adjustment of railroad labor problems with mutual confidence and justice.
—*Director General Hines.*

provements. The Esch bill as passed by the House provides for a similar fund of $250,000,000. Senator Frelinghuysen read a letter from Director General Hines in which he estimated that the railroad companies could hardly expend more than $400,000,000 in 1920 for capital improvements, because he said that they would hardly be in a position to go ahead definitely before March 1, although he expressed the opinion that at least 50 per cent additional ought to be expended.

The principal provisions of the Cummins bill, which includes a direction to the Interstate Commerce Commission to so regulate rates as to produce a net operating income of 5½ per cent on the aggregate value of railroad property in a district, with discretion to allow another one-half per cent for so-called "unproductive improvements," but requires the companies to contribute to a general railroad contingent fund the larger proportion of any earnings above 6 per cent, were not disturbed. The bill also provides for a federal transportation board to take over many of the functions of the Interstate Commerce Commission and some important new ones, for the gradual consolidation of the railroads within seven years into 20 to 35 competing systems, for the regulation of security issues and for many other important changes in the act to regulate commerce. The present guarantee is continued temporarily for six months or until the Interstate Commerce Commission acts upon new rates to be proposed by the railroads, and provision is made for the funding of the indebtedness of the carriers to the government. A bi-partisan committee of wages and working conditions is created to pass upon labor controversies and in the event of its failure to decide a final decision may be given by the transportation board, to be appointed by the president. The prohibition against strikes was vigorously assailed during the debate, but was left in the bill unchanged.

In a final effort to defeat the bill Senator LaFollette of Wisconsin, its principal opponent, offered an amendment providing for the two-year extension of federal control which has been urged by the labor organizations, but this was voted down by a vote of 65 to 11.

The Cummins bill as passed by the Senate and the Esch bill as passed by the House on November 17 were referred to a conference committee consisting of five members of the interstate commerce committee of each house for the purpose of reconciling the many fundamental differences, which are of such great importance that it will doubtless take several weeks to secure an agreement which can be adopted by both the Senate and the House. Under the rules the conferees cannot strike out anything that is in both bills nor insert anything that is not in one of the bills except as to the details of conflicting provisions which cover the same points.

The Esch bill also provides for the return of the roads at the end of the month in which the bill becomes a law, but it does not include the transportation board, the rule of rate-making, the plan of compulsory consolidation nor the anti-strike section, while its provisions for the adjustment of labor disputes, for the funding of indebtedness, for the guaranty and many other sections of the bill that deal with matters covered by the Senate bill differ in detail. Its labor provisions confirm for the future the orders of the Railroad Administration covering hours, wages and working conditions until superseded by mutual agreement between the railroads and their employees or by the wage boards provided for.

The date fixed for the return of the roads gives two more months for Congress to complete its proposed legislation, now in the hands of conferees, for the Railroad Administration to complete its preparations for the transfer, and for the corporations to place themselves in readiness to resume operation. It also coincides with the date which might very likely be agreed upon by the conferees, because the Senate bill provides for the return at the end of the month in which the act is signed, while the House bill fixes the date at the end of the following month in case the bill should become a law after the fifteenth of the month. It also removes the fear that the railroads might be returned without any guarantee and under the condition of uncertainty which will exist until Congress finally passes a permanent railroad bill as well as the fear that had recently begun to take form in some minds that the President had been induced to retain the roads for another year or two.

Officers of the Railroad Administration had been left entirely in doubt up to the last minute but had been going ahead on the assumption that the President would carry out his intention as expressed last May of relinquishing the roads at the end of the year, and therefore had made their plans for winding up their affairs at that time, although most of them apparently have recently accepted the conviction that the date would be postponed for a month or two. The Railroad Administration had made practically complete plans for the organization it would be necessary to retain after the first of the year for carrying out the large amount of adjustment work.

TEN MONTHS' DEFICIT $269,000,000

The government's deficit from the operation of the railroads for the 10 months of this year ending October 31, as compared with the standard return guaranteed to the companies, was $269,000,000. The net operating income for the 10 months was $478,982,635, as compared with the standard return for that period of approximately $748,000,000. Ten-twelfths of the standard return, however, is $743,563,000. In order to break even with the standard return it would be necessary to earn over $400,000,000 more of net operating income in November and December.

In 1918 the net operating income for those two months was only about $85,000,000, but it was reduced by retroactive wage increases. The net operating income for October, in which the volume of traffic handled was greater than for October, 1918, or October, 1917, was $76,959,777, whereas for October, 1918, it was $86,184,486.

After making adequate allowance for the per diem balance and some coal earnings which will not appear until the November accounts are compiled, the Railroad Administration issued a statement estimating that the net operating income for the month would be about $86,000,000. This does not reflect the loss of traffic caused by the coal strike, but it does reflect extraordinary expenses incurred in making preparation for it.

The Railroad Administration in its monthly statements regarding earnings and expenses has compared the net operating income with one-twelfth of the standard return each month, because its guarantee is payable in equal instalments, but this has had the effect of overstating its deficits during the first part of the year as compared with the income for the corresponding period of the test period and of understating it during the last part of the year when business is always heavier. The statements that the railroads have earned a surplus during the months July to October of this year has aroused so much discussion among those who did not fully understand the basis on which they were compiled that Director General Hines has issued a statement explaining that while the roads earned $22,000,000 more than four-twelfths of the standard return, during those four months they earned $29,000,000 less than during the same months of the test period.

MOTOR TRUCKS IN MAINTENANCE

THE PENNSYLVANIA Railroad recently purchased two motor trucks for the express purpose of relieving work train service. These trucks are located on busy main line territory where the public roads give access to the railroad at frequent points. Each truck is under the jurisdiction of a supervisor, one being located at Paoli, Pa., on the Philadelphia division, and the other at Newport on the Middle division. These trucks are used for delivering small track materials, delivering coal to stations and towers, hauling ashes and other refuse, the maintenance of station grounds and numerous other items of work which heretofore involved the hiring of teams or trucks.

The truck at Newport has been in service approximately five months and in that time has entirely replaced an extra work train, which was formerly used about one day a week. It has, as well, obviated the necessity and the expense of hiring teams. Since this truck was purchased it has covered approximately 3,000 miles and has used on the average 4½ gal. of gasoline per day. It has been working daily, except Sundays, eight hours per day, and up to the present time there has been no expense for repairs.

The following is a comparative statement of the cost of work train and hired teams as against the cost of doing the same work by motor truck:

ANNUAL OPERATING EXPENSES OF TRUCK

Interest on investment	$ 288.84
Depreciation at 20 per cent	962.75
Gasoline	337.75
Oil	45.00
Wages of driver and helpers	2,663.00
Tires and repairs (estimated)	400.00
License	25.00
Total	$4,722.34

ANNUAL COST OF CORRESPONDING WORK TRAIN AND HIRED TEAMS

Work train, 56 days—	
Labor	$3,655.68
Work train expenses and crew	3,188.64
Hired teams	753.40
Total	$7,597.72
Annual saving	$2,875.38

Prior to January, 1919, the delivery of coal and the removal of ashes from stations, watch boxes and towers on sub-division No. 2, Paoli, was made by work trains, as was also the delivery of supplies for the upkeep of stations, sidings and bridges. In other words, the materials required by the master carpenter, such as cement, sand, gravel, lumber, nails, etc., were transported by work trains. During 1918 the condition of the track demanded more service from the work trains and the question of relieving them from the above-mentioned work by the use of a truck was considered.

The following is a summary of the cost of the work done by the work train and the work done by this truck:

ANNUAL OPERATING EXPENSES OF TRUCK

Interest on investment	$ 164.40
Depreciation at 20 per cent	548.00
Gasoline	425.00
Oil	85.00
Wages of driver and helpers	4,180.00
Expenses, repairs, etc.	235.00
License	15.00
Total	$5,652.40

COST OF CORRESPONDING WORK TRAIN SERVICE

Cost of delivering coal	$4,497.60
Hired teams	233.25
Handling ashes	1,170.00
Work train for mason's and carpenter's supplies	2,400.00
Total	$8,300.85
Annual saving	$2,648.45

Because of the good roads in this section a truck was able to reach all the points on the sub-division except two towers. In January, 1919, a 2-ton truck was purchased and placed in service. This truck has now been in service 10 months, working 10 hr. a day for 8 months and 16 hr. a day for two months. It has relieved the work train of all the work named above and has also been able to expedite the delivery of repair parts necessary on the sub-division. During the 10 months this car has been in service the bills for repairs have totaled but $20, while an average of five gallons of gasoline and one quart of oil have been used per day.

MATERIAL MARKET

THE BEGINNING of 1920 finds the material market in all its branches more of a seller's market than at any time during the year just completed. Business has now fully recovered from the uncertainty which ensued immediately after the signing of the armistice, while the subsequent labor unrest has served to disturb production. The output in the steel industry has recently been suffering from two disturbing agencies—the strike in the steel industry and the shortage of coal consequent to the strike in the bituminous coal fields. This has served to effect a disproportionate relation between supply and demand and in consequence many mills are sold out for six months to come. In some cases the orders taken for delivery during the first half of this year are on the basis of prices in effect at the time that delivery is made.

The railroads have been in the rail market for some time but, in general, contracts have not been closed because of the uncertainty as to the termination of government control. The President's recent proclamation definitely fixing the end of the Railroad Administration's authority ought to be reflected shortly by the placing of many orders for rails.

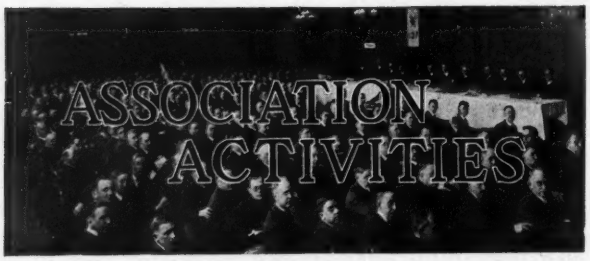
The question of prices still remains in a rather indefinite state. Prices established by the steel manufacturers a year ago are still nominally in effect, although there are frequent records of orders placed at higher rates. This is particularly true of material sold for export. In a few items there have been definite advances. Wire nails have been sold as high as $4.50 per 100 lb., while steel bars are now $2.75, Pittsburgh, and $2.87, Chicago. The established prices with the modifications mentioned are presented below:

	Prices in Cents per Pound	
	Pittsburgh	Chicago
Track spikes	3.35	3.62
Track bolts	4.35	4.62
Angle bars	2.75	2.75
Tie plates, steel	....	2.75
Tie plates, iron	....	2.90
Wire nails	3.25 to 4.50	....
Barbed wire, galvanized	4.10 to 4.40	....
Cast iron pipe, 6-in. or larger (per ton)	....	$59.80
Plates	2.65	2.92
Shapes	2.45	2.72
Bars (steel)	2.75	2.87

The scrap buying at present is slow but the prices remain strong as indicated by the quotations following:

	Chicago	St. Louis
	Per Gross Ton	
Relaying rails	$40.00 to $50.00	$38.00 to $45.00
Rerolling rails	31.00 to 32.00	32.00 to 32.50
Rails less than 3 ft. long	25.00 to 25.50	25.00 to 25.50
Frogs and switches, cut apart	20.50 to 21.50	21.50 to 22.00
	Per Net Ton	
No. 1 railroad wrought	$23.00 to $24.00	$28.00 to $28.50
Steel angle bars	21.50 to 22.00	21.50 to 22.00

The lumber market is also suffering from inadequate production. Just recently torrential rains in the yellow pine territory have been an important factor.



THE ROADMASTERS' ASSOCIATION.

The officers are still working on the personnel of the committees for the ensuing year, this work having not yet been completed. It is hoped that an announcement of the complete personnel can be made in the near future in order that the committees can begin work.

AMERICAN WOOD PRESERVERS' ASSOCIATION.

Plans are maturing rapidly for the annual convention which will be held at the Hotel Sherman, Chicago, on February 10-12. Several reports have already been completed and are in the hands of the Publication committee, while practically all of them will be printed and distributed to the members in advance of the convention. The report on Service Records will be particularly thorough, containing as it does the results of a number of inspections of track and piling. The National Association of Railroad Tie Producers will hold its meeting at the same hotel on February 12-13. The Wood Preservers' Association is preparing its program so that those papers and reports of common interest to the members of the two associations will be presented on February 12.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.

Practically all of the committee reports for the next annual convention of the American Railway Engineering Association have been turned over to the secretary and a large number of them are now on the press. It is anticipated that the first bulletin containing committee reports will be mailed soon. Some of the reports are much more voluminous than usual, so that the amount of material submitted to the members for their consideration before the convention will be much larger than has generally been the case. Much interest has been taken in Bulletin No. 219, recently issued, which contains written discussion received by the Committee on Iron and Steel Structures on the new specifications for steel bridges submitted to the association last year.

BRIDGE & BUILDING ASSOCIATION SELECTS COMMITTEES.

The assignment of committee work and selection of committee members has been completed much earlier than usual by the American Railway Bridge & Building Association so that the work of preparing the committee reports for the convention of this association will get a good early start this year. The committee assignments, and the membership of these committees, are given below:

FILLING BRIDGES—MAINTENANCE OF STRUCTURE DURING FILLING.
R. E. Sheahan, C. B. & Q., Chicago.
F. Gable, P. & R., Catawissa, Pa.
J. F. Pinson, C. M. & St. P., Seattle, Wash.
W. B. Harris, M. & O., Corinth, Miss.
W. E. Burns, S. P., San Francisco, Cal.
G. A. Manthey, D. S. S. & A., Marquette, Mich.
R. J. Bruce, M. P., St. Louis, Mo.
C. E. Smith, Consulting Engineer, St. Louis, Mo.
A. S. Clopton, M. K. & T., Oklahoma City, Okla.

STANDARD FORMS FOR BRIDGE INSPECTION
Arthur Ridgway, D. & R. G., Denver, Colo.
T. J. Harvey, B. & A., Pittsfield, Mass.
C. W. Lentz, I. C., Memphis, Tenn.
Geo. E. Boyd, D. L. & W., Buffalo, N. Y.
M. E. Nelson, A. C. L., Wilmington, N. C.
J. J. Taylor, K. C. S., Texarkana, Tex.
R. H. Helick, P. R. R., East Liberty, Pa.
W. A. Clark, D. & I. R., Duluth, Minn.

THE ABUSE OF TREATED TIMBER.
A. J. James, A. T. & S. F., Topeka, Kans.
S. L. McClanahan, C. R. I. & P., Herington, Kans.
J. S. Huntoon, M. C., Detroit, Mich.
F. A. Taylor, B. & O., Cumberland, Md.
F. L. Thompson, I. C., Chicago, Ill.
Hermann Van Schrenk, Timber Engineer, St. Louis, Mo.

REPAIR AND MAINTENANCE OF TANK HOOPS.
F. A. Benz, B. R. & P., Salamanca, N. Y.
E. C. Zinemeister, B. & O., Newark, Ohio.
C. W. Wright, L. I., Jamaica, N. Y.
G. W. Welker, Southern, Alexandria, Va.
J. H. Grover, A. T. & S. F., Needles, Cal.
A. W. Smith, Can. Nat., Winnipeg, Man.
J. L. Winter, S. A. L., Waldo, Fla.

APPLICATION OF PAINT BY SPRAYING.
James R. Shean, Pac. Elec., Los Angeles, Cal.
A. W. Reynolds, P. R. R., Jersey City, N. J.
H. H. Harman, B. & L. E., Greenville, Pa.
Chas. Ettinger, I. C., Chicago.
O. F. Barnes, Erie, Jersey City, N. J.
J. S. Robinson, C. & N. W., Chicago.
R. H. Reid, N. Y. C., Cleveland, Ohio.

MAINTENANCE OF TIMBER DOCKS.
F. C. Baluss, D. M. & N., Duluth, Minn.
R. C. Young, L. S. & I., Marquette, Mich.
L. J. Anderson, C. & N. W., Escanaba, Mich.
W. J. O'Brien, C. M. & St. P., Milwaukee, Wis.
B. W. Guppy, B. & M., Boston, Mass.
H. A. Gerst, G. N., St. Paul, Minn.
T. W. Bratten, S. P., Oakland Pier, Cal.
A. J. Catchot, L. & N., Ocean Springs, Miss.
F. N. Graham, D. M. & N., Duluth, Minn.

RECLAMATION OF BRIDGE, BUILDING AND WATER SUPPLY MATERIALS.
G. T. Richards, C. M. & St. P., Tomah, Wis.
P. Aagard, I. C., Chicago.
F. E. Schall, L. V., So. Bethlehem, Pa.
J. J. Murphy, S. P., Oakland, Cal.
W. A. Pettis, N. Y. C., Rochester, N. Y.
G. W. Andrews, B. & O., Baltimore, Md.
J. J. Wishart, N. Y., N. H. & H., Boston, Mass.
W. J. Jackson, C. & N. W., Winona, Minn.

THE USE OF ELECTRICITY FOR PUMPING WATER.
L. A. Cowsert, C. N. O. & T. P., Danville, Ky.
E. A. Demars, O. S. L., Salt Lake City.
C. W. Fellows, C. & S., Denver, Colo.
E. R. Wenner, L. V., Ashley, Pa.
A. I. Gauthier, B. & M., Concord, N. H.
Geo. W. Rear, S. P., San Francisco.

MAINTENANCE AND REPAIRS OF FREIGHT HOUSE FLOORS.
F. H. Soothill, I. C., Chicago, .
D. Rounesville, C. & N. W., Chicago.
J. P. Gallagher, N. Y. C., New York.
A. T. Hawk, C. R. I. & P., Chicago.
C. P. Rawson, C. M. & St. P., Chicago.
Thos. D. McMahon, G. N., St. Paul, Minn.
C. J. Scribner, C. B. & Q., Chicago.
D. L. McKee, P. & L. E., McKees Rocks, Pa.
S. C. Tanner, B. & O., Baltimore, Md.

MAINTENANCE OF WAY CONVENTIONS.

American Railway Bridge and Building Association, C. A. Lichty, secretary, C. & N. W., Chicago. Next annual convention, Atlanta, Ga., October 19-21, 1920.

American Railway Engineering Association, E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next annual convention, Congress Hotel, Chicago, March 16-18, 1920.

American Wood Preservers' Association, F. J. Angier, secretary, Mount Royal Station, Baltimore, Md. Next annual convention, Hotel Sherman, Chicago, February 10-12, 1920.

Maintenance of Way Master Painters' Association of the United States and Canada, E. E. Martin, secretary, Room 19, Union Pacific Building, Kansas City, Mo. Next annual convention, Detroit, Mich., October 5-7, 1920.

Roadmasters' and Maintenance of Way Association of America, P. J. McAndrews, secretary, C. & N. W., Sterling, Ill. Next annual convention, St. Louis, Mo., September 21-23, 1920.

GENERAL NEWS DEPARTMENT

The American Association of Engineers announces that it will conduct its second annual conference of professional engineers in railroad service in Chicago, on March 15, 1920.

The American Concrete Pipe Association will hold its annual convention in the Great Northern Hotel, Chicago, on February 20 and 21. The general sessions of the convention will be held in the lecture rooms of the Western Society of Engineers.

The Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, according to a Detroit dispatch of January 5, has purchased knitting, underwear, glove and tubing factories, which the union proposes to operate as a means of cutting down the cost of living. The venture represents an investment of $1,000,000.

The Michigan Supreme Court holds that where the driver of an automobile running 10 miles an hour had an unobstructed view while the defendant's on-coming train, running 40 miles an hour, was traversing 225 ft. before it reached the crossing, and he failed to look and apply the brakes in time to prevent a collision, the railroad was entitled to a directed verdict.

The War Finance Corporation's report for the year ended November 30, 1919, shows $89,699,690 was loaned to railroads on secured notes, of which $19,341,480 was repaid. The corporation took $15,523,800 out of a total of $43,000,000 notes issued by five railroad companies, and advanced $50,000,000 to the director-general. The amount of railroad loans outstanding at the date of the report was $70,358,210.

The Illinois Southern Railroad, extending from Salem, Ill., southwest 127 miles to Bismarck, Mo., has ceased operation, under an order entered on December 11 by Federal Judge George Carpenter in the United States District Court at Chicago. The order was issued at the request of W. W. Wheelock, receiver of the property, after foreclosure proceedings had been started by the bondholders, represented by the Chicago Clearing-House Association.

The total cost of the nine days' railway strike in Great Britain, which was called on September 26 and ended on October 5, 1919, is estimated at about $50,000,000, including delay in demobilization, estimated at $25,000,000. Mr. Bottomley, Independent Labor member, called on the government at once to introduce legislation rendering illegal any stoppage of public services at the instance of trade union executives without due notice to and a ballot of the members concerned.

The railroads' fire losses in 1918 on the 419 roads under federal control amounted to a total estimated loss of $12,263, 220, the result of 20,628 fires reported, which were divided into two general heads, (1) buildings and contents with a loss of $6,777,410 and (2) rolling stock and lading with a loss of $5,485,810. Sparks from locomotives proved to be the largest contributing cause for fire, causing a total of 9,923 fires with a loss of $2,822,247.

The derailment of a gasoline motor car on the Muscatine, Burlington & Southern, three miles south of Muscatine, Iowa, on the evening of December 4, caused the death of three persons, while the remaining occupants of the car, 13, were injured. The gasoline tank was punctured and took fire when the car was thrown off the track by a defective rail. Because the only available exit was on the side next to the ground, escape was delayed until a man broke a window in the rear end of the car.

Engineering Council recently mailed to 50,000 engineers an appeal for funds to carry on its work. This extraordinary measure was necessitated by present financial conditions resulting from the war. Engineers are expecting much of the council and commending the work which it has done. In order, however, that the council may continue its work for professional welfare and civic service, not less than $45,000 is needed for 1920. Of this amount, $30,000, at least, must come from general contributions. To December 16, 550 contributions have been received, totaling $3,843. They range from one dollar to $100 each and average $7.

The Railway Association of Canada has received complaints regarding the burning of worn-out ties which could be utilized for fuel. The association has issued a circular noting these complaints and referring to the existing shortage of fuel. The complainants have been informed that the railways would be glad to give surplus old ties to people who want them, provided this can be done without expense to the railways. The Association further suggests that where surplus worn-out ties are available the railways give notice to municipal officers.

The Chicago, Milwaukee & St. Paul is soon to receive five 265-ton electric locomotives of the 3,000 volt, direct-current, gearless type, for use on the Othello, Seattle and Tacoma electrified zones. In a recent test of one of these locomotives, it demonstrated its good riding qualities at high speed, its regenerative ability and its high tractive effort in a successful manner. During the test two large steam locomotives were coupled to the big electric, but it was easily able to handle them in both the regenerative braking test and in the traction test.

The reservation of seats in dining cars by means of tickets distributed to passengers before meals has been a regular and satisfactory practice on the Congressional Limited trains of the Pennsylvania Railroad for the past year. The hours between 5:30 p. m. and 8:30 p. m. have been divided into four periods of 45 min. each and the table reset after the end of each period. Tickets for the four periods have different colors and little or no confusion has resulted from this practice, while there has been only occasional objections on the part of the passengers because of the inconvenience of the hours.

A project for a bridge over the Detroit River at Detroit, which has been subject to discussion and engineering investigation for some time, is now in the hands of an American and a Canadian corporation, which have undertaken the construction. Gustave Lindenthal, consulting engineer, New York City, has been appointed the consulting engineer, and Charles Evan Fowler, consulting engineer, New York City, has been made chief engineer of the joint board representing these two corporations. The tentative plan provides for a double deck structure, providing for highway and railway traffic with a main span of 1800 to 2400 ft., depending upon the final location adopted.

A record in rapid reconstruction was made by the Louisiana & Northwest after two cars in a train were derailed at 8:45 p. m. on December 3. The derailment caused the first five bents of bridge 23-7, a timber trestle, to be knocked down and exactly 24 hours later the bridge was completed and another train passed over it. A large part of the material used in the reconstruction of the structure was standing timber in the forest some miles distant at the time of the accident. An order was given to a lumber company for the material required, which was cut and milled, and was then transported to the site of the bridge, where it was fitted and erected by bridge forces working under the direction of T. R. Barger, roadmaster.

Senator Thomas of Colorado has introduced a bill in the Senate to require the railroads to coat their ties and roadbeds with "a suitable covering of hydraulic cement of good quality, which shall render the roadbeds practically waterproof and exclude water from coming into contact with the roadbeds and thus render them soft, unstable and dangerous for the operation of cars and rolling stock thereon and thereover." The bill, which is S. 3278, sets forth in the preamble that its purpose is "to more fully insure the safety of human life and property, to reduce the cost of transportation and to make the railways better both physically and

financially." One section of the bill would make it unlawful for a railroad to lay any cross ties which have been artificially treated by any process by which any poisonous substance may have been injected into the wood.

The head of one large steel union, in commenting on the decision of the heads of twenty-four unions involved in the steel strike to continue the struggle, is quoted in the New York World as follows: "It does not matter whether the strike is called off or not. The strike is dead; Fitzpatrick knows it and we know it. What's more, Judge Gary and the public know it."

A complete record of the building of the Quebec bridge has been prepared by the Engineering Institute of Canada, which has published in Volume 32, Part I and Part II, a collection of the papers on this structure presented before that society during the progress of the work. The first volume contains papers by C. N. Monsarrat, George F. Porter, Phelps Johnson, G. H. Dugan and A. L. Harkness, while the second volume contains a collection of drawings.

Engineering Council during the December meeting received a report from the committee on classification and compensation of engineers, which contained a proposed classification for engineers in federal, state, county, municipal and railway employment. It also appointed a committee to consider types of government contracts, consisting of: Arthur P. Davis, chairman; D. K. Boyd, Harold W. Buck, J. A. Capp, Peter Junkersfeld, W. M. McFarland, Admiral H. H. Rousseau and Colonel Clarence O. Sherrill. Three conferees have been appointed on the subject of "Payment for Estimating," who are T. L. Condron, Ralph Modjeski and S. G. Neiler. They are collaborating with an equal number of representatives each of the American Institute of Architects and the Associated General Contractors of America.

An ordinance requiring the depression of the tracks of the Chicago, Milwaukee & St. Paul in Minneapolis, Minn., and calling for the elevation of the city streets over the tracks is now pending before the Minneapolis city council. The ordinance is practically a compromise in a discussion between the city of Minneapolis and the Chicago, Milwaukee & St. Paul, relative to the matter of grade separation, which has been in progress since 1916. At that time an ordinance was introduced and adopted by the city council requiring this road to depress its tracks and carry them under certain streets and avenues. This ordinance was resisted in the United States Court by the railroad company and was consequently held to be void.

The Interstate Commerce Commission has issued tables summarizing the annual reports of the Class I roads for the calendar year 1918. The following figures were taken from the reports of Class I roads operated by the United States Railroad Administration:

Average number of miles of road operated	230,422.19
Railway operating revenues	$4,850,991,013
Railway operating expenses	$3,948,132,199
Net revenues from railway operation	$902,858,814
Total operating income	$718,460,592
Gross income	$892,861,006
Total deductions from gross income	$123,145,765
Net income	$769,715,241

The expenditures for maintenance of way and structures totaled $644,606,618, which is equivalent to an expenditure of $2,797 per mile of line operated. The summary of federal operations is an aggregate of the reports of the individual operating units and does not include the expenses of regional and central offices of the United States Railroad Administration, which amounted to $3,647,143.23.

At the fiftieth anniversary dinner of the Western Society of Engineers, held at the Hotel Morrison, Chicago, on Tuesday evening, December 2, announcement was made of the setting aside of a sum of $5,000 by Robert W. Hunt, president of Robert W. Hunt & Co., Chicago, the income from which is to constitute a prize to be awarded annually to the person not over 30 years of age presenting the best paper before the society on the manufacture of iron and steel. Three prominent engineers are to constitute a Committee on Award, one of whom must be a person of recognized authority in the iron and steel field. In the event that the judges do not consider that any paper worthy of this prize has been presented during a given year, the income from the fund for that year will go to St. Luke's hospital, Chicago, while in the event that no award is made for five consecutive years, the principal itself will be turned over to the hospital and the trustees discharged. The establishment of this award has for its purpose the encouragement of the younger men and to direct attention to the problems of the steel industry in the Middle West.

The distribution of the railway dollar is one of the striking features of the annual report of the Bureau of Railway News and Statistics for 1918, and is shown in comparison with 1916, as follows:

	Where it went in 1918	in 1916
Labor	54.06	40.60
Fuel and locomotive supplies	11.11	7.45
Material and supplies	14.40	15.77
Loss and damages	2.02	1.67
Taxes	3.87	4.46
Total expenses	85.46	69.95
Interest	8.74	12.48
Rent of leased lines	2.59	3.96
Betterments	.56	1.83
Available for dividends, reserves and surplus	2.65	11.78
Total	100.00	100.00

The Joint Concrete Culvert Pipe Committee, consisting of members from engineering societies and other organizations, has recently made announcement of its full membership as follows: American Concrete Institute—B. S. Pease, American Steel & Wire Company, Chicago, and A. B. Cohen, Delaware, Lackawanna & Western, Hoboken, N. J.; American Association of State Highway Officials—T. R. Agg, Iowa State College, Ames, Iowa, and J. N. Mackall, Maryland State Roads Commission, Baltimore, Md.; American Railway Engineering Association—Job Tuthill, chief engineer, Pere Marquette, Detroit, Mich., and A. F. Robinson, bridge engineer, Atchison, Topeka & Santa Fe, Chicago; American Society for Testing Materials—H. T. Shelley, assistant engineer, sewer construction, Department of Public Works, Philadelphia, Pa., and A. E. Phillips, sanitary engineer, Washington, D. C.; American Society of Civil Engineers, George H. Tinker, bridge engineer, New York, Chicago & St. Louis, Cleveland, Ohio, and T. L. D. Hadwen, engineer of masonry construction, Chicago, Milwaukee & St. Paul, Chicago; American Concrete Pipe Association, Paul Kircher, Massey Concrete Products Corporation, New York, and C. F. Buente, Concrete Products Company of America, Pittsburgh, Pa.; Office of Public Roads, T. H. MacDonald and A. T. Goldbeck, office of Public Roads, Department of Agriculture, Washington, D. C. An unofficial sub-committee of this committee recently made a visit to Ames, Iowa, to witness tests being made by the Experiment Station of the Iowa State College in conjunction with the Iowa State Highway Commission.

The American Association of Engineers has issued a statement of its position with reference to trade unionism in the profession. The following is an abstract from this statement:

"Production should be increased—not limited. The profession cannot support strikes or lockouts or any other methods that may benefit any class at the expense of the nation as a whole.

"Rewards should be according to ability, initiative and constructive effort. Men are not equal in these respects. Each man should be encouraged to do his utmost and be given compensation according to ability and will to increase production and to achieve large results.

"The engineer, as an educated professional man, believes in basing his claims for proper and just reward for his services upon the justice of the facts presented, upon enlightenment of public opinion, upon loyalty between employer and employee, and upon the underlying fundamental desire of the great majority to do what is fair and right when the merits of the case in question are clearly presented and demonstrated. We believe in organized representation for the correction of wrong, the advancement of the profession and service to the public, but are opposed to methods inconsistent with the dignity of the profession and which would lessen public confidence."

PERSONAL MENTION

GENERAL

Colonel C. W. P. Ramsey has been appointed acting superintendent of the Brownville division of the New Brunswick district, of the Canadian Pacific, with headquarters at Brownville Junction, Me., in place of **J. H. Boyle** who is on leave of absence. Prior to entering the army, Colonel Ramsey was engineer of construction, which work he resumed on his return until his recent appointment as noted above.

William B. Storey, Jr., federal manager and chief executive officer of the Atchison, Topeka & Santa Fe, has been elected president, succeeding **Edward P. Ripley,** who has been elected chairman of the board of directors, effective January 1, 1920. On account of Mr. Storey's technical training and experience as an engineer, combined with his experience and outlook as an operating officer and executive, he has long been regarded as Mr. Ripley's logical successor. Mr. Storey was born at San Francisco, Cal., on November 17, 1857, and graduated from the University of California in 1881. He served as an axman on the Southern Pacific for one year prior to his graduation from college. He entered railway service in 1881 as a rodman on the Southern Pacific and was later levelman, transitman and assistant engineer. From 1893 to 1895, he was assistant engineer with the United States Hydraulic Mining Commission. In the latter year he was appointed chief engineer and general superintendent of the San Francisco & San Joaquin Valley, in which position he remained until 1900, when he was appointed chief engineer of the Santa Fe System, which position he held until he was promoted to vice-president in charge of operation and construction in 1909, remaining vice-president until government control was inaugurated.

William B. Storey, Jr.

ENGINEERING

C. O. Foss, chief engineer of the St. John & Quebec, has been granted leave of absence to go to British Columbia.

W. W. James has been appointed assistant valuation engineer of the Central of New Jersey and the New York & Long Branch.

H. L. Laning has been appointed assistant valuation engineer of the Philadelphia & Reading, the Atlantic City, and the Port Reading.

L. C. Murphy, designing engineer on the Boston & Albany, has been appointed principal assistant engineer, his duties remaining unchanged.

J. E. Willoughby, chief engineer of the Atlantic Coast Line at Wilmington, N. C., has also been appointed chief engineer of the Georgia and the Charleston & Western Carolina.

E. Y. Allen, assistant valuation engineer of the Philadelphia & Reading and the Central of New Jersey, with headquarters at Philadelphia, Pa., has been promoted to valuation engineer of those roads and of the New York & Long Branch, the Atlantic City, the Port Reading, the Baltimore & Ohio New York Terminals, the Baltimore & New York, the Staten Island Rapid Transit and the Staten Island.

Carl Tombo, principal assistant valuation engineer of the Philadelphia & Reading and the Central of New Jersey, with headquarters at Philadelphia, Pa., has resigned and taken up private practice of engineering in the West, with headquarters at Placerville, Cal.

A. C. Mackenzie, engineer of maintenance of way of the Canadian Pacific, Western Lines, has been transferred to the Eastern Lines, with headquarters at Montreal, Que., in place of **Frank Lee,** transferred to the Western Lines, with headquarters at Winnipeg, Man.

Michael Lipman, whose appointment as division engineer of the West Jersey & Seashore, with headquarters at Camden, N. J., was announced in last month's issue, was born at Annandale, N. J., in January, 1881. After graduating from Rutgers College Mr. Lipman entered the employ of the Pennsylvania Railroad in February, 1901, as a rodman at Jersey City, N. J. He was subsequently promoted through the various grades and was appointed assistant supervisor at Jamesburg, N. J., in January, 1904. Later on he was transferred to Perryville, Md., and Altoona, Pa. On December 1, 1908, he was promoted to supervisor at Osceola Mills, Pa., and subsequently served in that capacity at Blairsville, Pa., Atlantic City, N. J., and East Liberty, Pa., from which latter place he was promoted to the position of division engineer of the West Jersey & Seashore Railroad and the Camden Terminal division, as noted.

Lieutenant-Colonel H. P. Warren has been recently appointed engineer in charge of the supply division of the Alaskan Engineering Commission, with general supervision over all supplies required for the construction of the Alaska railroad, with headquarters at Seward, Alaska. Lieutenant-Colonel Warren was appointed a major in April, 1918, and assigned to the 55th Engineers, going "overseas" with them in the latter part of June, 1918. In February, 1919, he was promoted to lieutenant-colonel and given command of the 55th Engineers. While in France, Colonel Warren had charge of the construction work at Geivres, double tracking of the railroad from Tours to Le Mans and numerous other construction work, including the building of the Pershing Stadium in Paris. Shortly after closing up the work of his section, he was returned to the States and discharged in the latter part of September, 1919, assuming the position as head of the supply division.

John R. Mackenzie, assistant engineer on the Canadian National, with headquarters at Toronto, has been promoted to assistant engineer maintenance of way, with the same headquarters. Mr. Mackenzie was born at Kirkfield, Ont., in January, 1878, and was graduated from the School of Science in 1900. He entered the employ of the Canadian National in the summer of 1898 as a rodman on construction in Manitoba. In the summer of 1899 he was a leveler on location on that road at Cape Breton and in 1900 was a transitman on location at the same place. From 1901 to 1903 he served as resident engineer on construction with headquarters at Parry Sound and from 1906 to 1912 was division engineer on construction with headquarters at St. Stanislas, Rawdon, Rockland and Cobourg. From 1913 to 1916 he was engaged in contracting. In 1916 he again entered the employ of the Canadian National as division engineer on maintenance with headquarters at Rosedale. Later he became assistant engineer at Toronto, which position he held until receiving his appointment as assistant engineer maintenance of way as noted above.

TRACK

J. A. Bryan has been appointed roadmaster of the Montana, Wyoming & Southern, with headquarters at Belfry, Mont.

D. S. Scott has been promoted to track supervisor on the Georgia Southern & Florida, succeeding **S. J. Harris,** who has retired.

W. M. Jacklin, roadmaster on the Toronto Terminals of the Canadian National Railways, with headquarters at Rosedale, Toronto, has been appointed roadmaster on the

Muskoka and Orillia subdivisions and that part of the Toronto Terminal subdivision between Todmorden and Duncan, succeeding **T. W. Brown**, who has been transferred.

W. F. Walker, section foreman, has been promoted to track supervisor on the south end of the Charlotte division of the Southern.

J. Kelly has been appointed roadmaster on the Chicago, Milwaukee & St. Paul in place of **P. H. Madden**, who has been assigned to duties on the general reclamation committee with headquarters at Wausau, Wis.

James Hanahan, roadmaster on the Alaskan Government Railway, with headquarters at Anchorage, Alaska, has been promoted to assistant superintendent of tracks in charge of maintenance and construction from Anchorage to the north end of the line.

Christ Hara, who was appointed division roadmaster on the Great Northern, with headquarters at Willmar, Minn., as noted in last month's issue, was born in Norway on December 9, 1877, and entered railway service in August, 1900, with the Great Northern as a section laborer. From October 16, 1903, to October 10, 1909, he served as section and extra gang foreman, and at the latter date was promoted to general foreman. On October 31, 1919, he was appointed assistant roadmaster, which position he held until his appointment as noted above.

Robert Bachar, who was promoted to roadmaster on the Indio district of the Southern Pacific, with headquarters at Niland, Cal., as noted in last month's issue, was born at Keokuk, Iowa, on April 15, 1876. Mr. Bachar entered railway service with the Missouri Pacific in 1896 and served as section hand and foreman in section and extra gangs until April, 1906. In April, 1906, he left this road to go with the Southern Pacific as foreman on the Los Angeles division, later being transferred to the Indio district, where he was promoted to general foreman, which position he has held for the past three years until his recent appointment.

John T. Ridgely, assistant supervisor on the Pennsylvania Railroad at Perryville, Md., whose promotion to supervisor with headquarters at South Oil City, Pa., was noted in these columns last month, was born at Tyrone, Pa., on June 9, 1887. Mr. Ridgely was educated in Lehigh University, graduating with the class of 1909. He began railway work in August of that year as rodman in the maintenance of way department of the Pennsylvania, where he has since been employed continuously, serving successively as transitman and assistant supervisor before receiving his recent appointment as supervisor.

W. A. Moberly, roadmaster in the Chicago terminals of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, has been transferred to the Illinois division, with headquarters at Elgin, Ill., in place of **A. Jung**, who has resigned. **H. C. Schneider** has been promoted to roadmaster in the Chicago terminals, succeeding Mr. Moberly. Mr. Schneider was born at Plox, Wis., on March 4, 1890, and entered railway service with the Chicago, Milwaukee & St. Paul on July 2, 1907, as an extra gang foreman. From September, 1918, to April, 1919, he was division supervisor of maintenance of way in the United States Army with the American Expeditionary Force in France.

D. F. Mulkern, temporary division roadmaster of the Havre division of the Great Northern, has been transferred to roadmaster on the district from Pacific Junction to Cut Bank, Mont., in place of **H. Petry**, assigned to other duties. **Nels Hovind** has been appointed roadmaster on the Kalispell division, with headquarters at Rexford, Mont., in place of **James Sullivan, Jr.**, who has been transferred. **R. S. Kniffen**, roadmaster on the Cascade division, with headquarters at Blaine, Wash., has been promoted to division roadmaster of the Havre division, with headquarters at Havre, Mont., in place of **R. Hughes**, who has resigned. **J. E. Campbell** has been appointed roadmaster on the Cascade division, succeeding Mr. Kniffen. Mr. Kniffen was born in Darien, Wis., on November 4, 1886, and entered railway service with the Great Northern on April 21, 1906, as a laborer. From 1906 to April, 1913, he served as laborer and foreman and was promoted to district roadmaster on the latter date, which position he held until his promotion as noted above.

H. V. Lange, whose appointment as roadmaster on the Chicago, Milwaukee & St. Paul, with headquarters at Sioux Falls, S. D., was announced last month, was born at Mederville, Iowa, on October 27, 1873. Mr. Lange entered railway service with the Chicago, Milwaukee & St. Paul in September, 1894, and served as section and extra gang foreman until November, 1912. He was transferred to the bridge and building department in February, 1913, in which department he served until March, 1914, when he went with the Chicago, Memphis & Gulf as section foreman. On April 15, 1915, he left this road to go with the Chicago Great Western as extra gang foreman, later being promoted to track supervisor. In November, 1918, he returned to the Chicago, Milwaukee & St. Paul and served as section foreman and extra gang foreman until his appointment as noted above.

BRIDGE

Walter F. Clayman, foreman in the bridge department of the New York Central Lines West, was promoted to assistant supervisor of bridges of the Erie and Franklin divisions, with headquarters at Ashtabula, Ohio, effective December 1, succeeding **G. W. Hellwig**, who was transferred to the Western and Illinois divisions, with headquarters at Chicago, in place of **E. J. Fraser**, who was transferred to Toledo, Ohio, succeeding **P. J. O'Neill**, who was retired on that date. Mr. Clayman was born at Westfield, N. Y., on April 7, 1892, and entered railway service with the New York Central on October 4, 1910, as a bridgeman. On December 15, 1915, he was promoted to bridge foreman. He enlisted in the army on March 23, 1918, and served as sergeant in the 33rd Engineers. After one year's service overseas on heavy construction work, he was discharged June 10, 1919, and resumed his position as bridge foreman, which position he held until his recent promotion as noted above.

PURCHASING AND STORES

G. V. Booth, storekeeper of the Detroit, Toledo & Ironton, has been promoted to general storekeeper at Jackson, Ohio.

T. H. Ryan, local purchasing agent at New Orleans, La., of the Vicksburg & Alabama, has been appointed purchasing agent of that road and of the Louisiana & Mississippi Transfer and the Vicksburg, Shreveport & Pacific.

W. W. Blowney has been appointed assistant purchasing agent in charge of purchases and stores of the Toledo, St. Louis & Western and the Detroit & Toledo Shore Line, with headquarters at Toledo, Ohio.

F. H. Fechtig, purchasing agent of the Atlantic Coast Line, with headquarters at Wilmington, N. C., has also been appointed purchasing agent of the Georgia and the Charleston & West Carolina.

W. N. Pollard, division storekeeper of the Southern at Columbia, S. C., has been transferred to South Richmond, Va., succeeding **W. F. Lamb**, deceased; **J. H. Smith** has been appointed Mr. Pollard's successor.

J. M. Mitchell, storekeeper of the Virginian at Roanoke, Va., has been transferred to Victoria, Va., succeeding **K. A. Fernstrom**, assigned to other duties. **J. V. Bland**, storekeeper at Sewalls Point, Va., has been appointed Mr. Mitchell's successor. **G. C. Donovan** has been appointed acting storekeeper, succeeding Mr. Bland.

OBITUARY

William Archer, formerly assistant engineer, Baltimore & Ohio, died on November 24, as the result of a fall.

Stephan Pearson Brown, a well-known tunnel engineer, among whose important works was the Mount Royal tunnel which affords the entrance of the Canadian Northern into Montreal, was drowned in a lake in Maine on December 6.

Walter B. Scout, civil engineer on the Pennsylvania Railroad, with headquarters in New York, died at his home in Elizabeth, N. J., on November 12, at the age of 57 years. Mr. Scout was born in Smyrna, Del., and had been in the continuous service of the Pennsylvania for 30 years. During that time his principal work included the planning and building of the trackage in the tubes of the Hudson & Manhattan and in the Greenville yards in Jersey City. He also built the Pennsylvania ferry houses on both sides of the North river.

Col. Henry W. Hodge, consulting bridge engineer, died at his home in New York on December 21. Colonel Hodge was born in Washington, D. C., on April 14, 1865, and was graduated from the Rensselaer Polytechnic Institute in 1885. He began his engineering work in the engineering department of the Chesapeake & Ohio and later entered the employ of the Phoenix Bridge Company as assistant engineer. In 1893 he began practice as an independent engineer. In 1895 he entered the employ of Alfred P. Boller, becoming a partner to Mr. Boller in 1899 under the firm name of Boller & Hodge, which lately became the firm of Boller, Hodge & Baird. Among some of the railroad bridges which he designed and built were the Great Northern bridge at Duluth, Minn., the Chicago, Rock Island & Pacific bridge at Little Rock, Ark., the bridges of the Choctaw, Oklahoma & Gulf, now part of the Chicago, Rock Island & Pacific, the cantilever bridges of the Wabash-Pittsburgh Terminal Company at Pittsburgh, Pa., and Steubenville, the Pecos Valley viaduct of the Southern Pacific, the Harlem River four-track drawbridge of the New York Central and all the structures on the National Railroads of Mexico. Colonel Hodge also was retained by the Canadian government as a consulting engineer on the Quebec bridge. In 1916 he was appointed public service commissioner of the first district of New York, from which position he resigned in July, 1917, to go to France on the request of General Pershing, being commissioned major in the Engineering Corps, later being commissioned lieutenant-colonel and then colonel. Colonel Hodge was attached to the staff of General Pershing in France as director of military railroads and bridges with the American Expeditionary Forces.

CONSTRUCTION NEWS

The California Southern has applied to the Railroad Commission of the State of California for authority to make an eight-mile extension southwest from its present terminus at Blythe, Riverside county, Cal., on account of the rapid increase in the development of the Palo Verde Valley, Cal., and the corresponding need for railroad service. To meet the cost of making this extension, the commissioners were also asked to authorize the issuance of bonds to the extent of $135,000.

The Central of Georgia will survey for a contemplated extension from Lockhart to Munson, Fla., a distance of 35 miles.

The Farmers of Lake St. John, Canada, are applying for a provincial charter to build and operate their own railway through the entire region, covering several hundred miles and giving the remote districts of the north an outlet on the gulf of St. Lawrence, probably at the mouth of the Saguenay river.

The Georgia Lumber Company proposes to extend its line to Americus, Ga., a distance of 10 miles. J. F. Morton, Byromville, Ga., is president.

The Illinois Central Railroad Company and the **Michigan Central Railroad Company** have made a joint application to the Public Utilities Commission of Illinois for an order consenting to the acceptance of an ordinance for the establishment of Harbor District No. 3, the construction by the Illinois Central of a new passenger station at Chicago, the electrification of certain of the lines of the Illinois Central and the Michigan Central within the city of Chicago and development of the Chicago lake front, passed by the Chicago City Council on July 21, 1919.

The Louisville & Nashville has recently announced the building of a 15-mile branch from the main line at Dalna, several miles from Whitesburg, Ky., where extensions are expected to be made next year by a number of big development factors. Starting from Dalna, the new branch will pass up Smoot Creek several miles, through Smoot Creek Gap and on to Rockhouse Creek; thence into the Rockhouse headquarters, the entire line traversing extensive coal and hardwood timber fields. H. C. Williams is engineer of construction with headquarters at Louisville, Ky.

The Louisiana & Northwest will build a new branch line from about two miles north of Homer, La., to the oil fields west of Homer. The main spur will be between five and six miles in length with sidings, the total mileage aggregating approximately 12 miles.

The Moorefield Southern Railroad Company has recently been organized to build a narrow-gauge line from Moorefield through the South Branch Valley to a point in Highland County, Va., a distance of approximately 60 miles. William B. Cornwell of Romney, W. Va., is president.

The Panhandle Short Line Railway Company has been organized by Missouri, Kansas and Texas industrial operators, who plan the construction of an 835-mile steam railway. Contracts for 200 miles will be awarded soon.

The Pere Marquette has awarded a contract to the Roberts & Schaefer Company, Chicago, for the design and construction of a 250-ton, three-track reinforced concrete automatic electric locomotive coaling and sanding plant at Plymouth, Mich., to replace a timber plant which was recently destroyed by fire. The contract price is $40,000.

The Sacramento Northern plans to extend its tracks from Sacramento, Cal., down the Sacramento river for a distance of five miles.

The Saint Clair Terminal has closed a contract with the Roberts & Schaefer Company, engineers and contractors, Chicago, for building a reinforced concrete automatic electric locomotive coaling and sanding plant, for installation at Clairton, Pa.

The Southwest Texas Construction Company, Wichita Falls, Tex., will build a railroad from La Junta, Colo., to Austin, Tex., by way of Delhart, Hereford, Lubbock, Big Springs, San Angelo, Brady and Linao.

The United States Steel Corporation reports unfilled orders on hand November 30, 1919, amounting to 7,128,330 tons, against 6,472,668 tons on October 31, 1919, an increase of 655,662 tons. On September 30, 1919, unfilled orders aggregated 6,284,638 tons; on August 31, 1919, 6,109,103 tons, and on November 30, 1918, 88,124,663 tons.

IRON AND STEEL

Sophus Berendsen is inquiring for 210 tons of 116-lb. groove rails with the necessary angle plates, tie bars and bolts, to be laid on the wharves in connection with harbor improvement work, and has ordered from the United States Steel Corporation 1,500 tons of 94-lb. rails and the necessary accessories for the Copenhagen Tramways.

George H. Carey, 1 Broadway, New York, is in the market for 150 tons of 20-lb. relaying rails.

The Government of Netherlands has ordered through its New York office 15,000 tons of steel rails for export to the Dutch East Indies.

Interests in Japan are asking for prices in this country on 2,000 tons of rails.

The V. V. Lebedjeff Engineering & Supply Company, 227 Fulton street, New York, is in the market for 2,000 tons of 12-lb. rails for export to the West Indies.

The Oneida & Western is inquiring for 12 miles of 40-lb. relaying rails with angle bars and spikes.

Perin & Marshall, 2 Rector street, New York, have given an order to the Consolidated Steel Company for 2,357 tons of 30-lb. steel rails with the necessary splices, bolts and dog-eared spikes; and for 50 complete turnouts for the Mysore State Railways (India).

FOREIGN RAILWAY NEWS

Railway lines in Madagascar are being built from Antsirable to Tamatave on the east coast, and from the famous lake of Alaotra to Majunga.

The minister of communications and public works in Brazil has appointed a commission to make a study and prepare a report for standardization on the State-owned railways.

A new railway in Nicaragua, 75 miles in length, is to be constructed from a point on the Cuculaya River, following the course of the Bamabana and Oconguas Rivers, of which 40 miles have already been constructed.

The Vossische Zeitung recently contained a report from Budapest that the Hungarian Cabinet and the British Commissioner had concluded an agreement stipulating that the entire Hungarian railway system will pass into British hands.

The Dutch Colonial Authorities have prepared an extensive program for railway construction in the East Indian colonies. It is estimated that it will take from 15 to 20 years to build the lines which, when completed, will total approximately 10,000 miles.

Sanction has been given to a preliminary survey by State engineers for a meter gage railway line by way of Hukong Valley to connect India and Burma. This will connect the existing line to Lakhimpur with the line from Mandalay along the Upper Irrawaddy valley.

The electrification of the Barra to Pirahy Railway in Brazil is likely to be carried out shortly in accordance with a recommendation of a government commission. The power will be obtained from one of the existing power companies. The cost of rolling stock, sub-station plant and transmission line will be approximately $4,000,000.

The Jugo-Slav government intends sometime in the near future to send an official commission to this country in the hope of raising a loan here to facilitate reconstruction of the railways. The idea of sending such a commission has been in hand for some time, but cablegrams from the American minister at Belgrade on December 2 indicated that the visit has been postponed for a few weeks.

An extension to the Katanga Railway, in the Belgian Congo, which now ends at Bukama, to a new terminus at a place which the Belgian Administration calls Kibouerbo, on the upper waters of the Congo, is proposed. This, it is expected, will overcome the difficulty of navigation on the upper channels between Kabolo and Bukama, which at present often necessitates the discharge of cargo owing to the lowness of the water.

The Chamber of Deputies of Buenos Aires is shortly to discuss a project which will authorize a French company to construct a railway across the Federal territory of Formosa for a distance of 180 miles. It is understood that several deputies intend strenuously to oppose this project, with the object of giving preference to a company which has been formed with Brazilian, Argentine and North American capital.

French and Italian Engineers lately met at Salanches to reconsider plans made by the engineer, M. Monod, in 1908, for piercing Mont Blanc with a new railway line from Salanches, on the Swiss side of the frontier, to Aosta, in Italy. The new line will be 50 miles long, with a tunnel 9 miles in length, similar to the famous Simplon tunnel. It is expected that work on the new undertaking will begin next spring.

The Beira & Mashonaland railway, running from Beira to Macequece and Umtali, is the only railway line at present in the Beira district of Portuguese East Africa, and is operated entirely by British employees. However, another railway is about to be constructed, which will connect up the Central African Railways with Beira, and will extend from Chindio, on the Central African Railways, to a point on the Beira & Mashonaland Railway about 20 miles out of Beira. The surveys have been completed, the total distance being about 200 miles. The gage is to be 3 ft. 6 in., the gage common to nearly all the South African railways.

The government of Chile has decided to electrify all railways under State control, utilizing for this purpose the abundant water power available from falls of the western slopes of the Andes. The State railways, administered from Santiago, comprise about 2,300 miles projected or under construction; they include the Longitudinal Railway, the Arica-La Paz, the Copiapo, and branches, the line to Coquimbo and branches, the Los Vilos line and the Central system.

The rebuilding in France of the destroyed parts of the Nord and Est railways has recently made great progress. On October 1, only 27 miles of track and two stations of the Nord line remained to be put in order. Nearly all the bridges are rebuilt, and only two tunnels, those at Feren and Folambray, remain to be reconstructed. On the Est railway, 105 miles of track are still to be put in order and only 24 stations are not open to the public.

Railway extensions in Jamaica are attracting a good deal of attention. The island has an area of 4,450 sq. miles and the population in 1916 was 892,406. At present the total length of the Jamaica railway is 197 miles. It is stated that there is a project to extend the railway and that a scheme had been projected to electrify the railway and thus do away with steam haulage; the waterfalls in Jamaica should make this possible.

The Greek government is undertaking an important railway and sea connection which will connect up the Salonica-Serres-Constantinople Railway at Drama with the Aegean Sea at Cavalla. The Drama-Cavalla line has been considered a commercial necessity for many years, but under Turkish rule nothing has been done. The line will be 27 miles long, as compared with 22.5 miles by the carriage road. On account of the mountainous country several tunnels are necessary, one of which will be 1.5 miles long.

The Council of Ministers of Italy has approved a plan, proposed by the Transport Minister, De Vito, for the electrification of the State railways. The bill provides for the exploitation of the national water power resources and their utilization for propulsion. The first program, which limited the improvement to 1,200 miles is now extended to 3,600 miles. This includes the two principal trunk lines across the Apennines, via the two "Direttissime," Genoa-Tortone and Bologna-Florence, eight mountain passes and the principal arteries of the railway system of the peninsula from Trient to Reggio, Calabria or from Turin to Trieste.

The completion of a new railroad to run from Valona on the Adriatic to Monastir, will not only benefit the undeveloped country of Albania, but will give Italy through communication across the Balkans with Constantinople. The efficiency of the railway will further be increased by two ferries which will carry the train over the Otranto Canal, linking the Italian system up with the new railway. It is also proposed to link up Durazzo, the most important port of Albania, by a branch line, which will run in an almost straight line through the plain of Kavaja along the old Roman road, via Egnatia. After diverging from this road and taking the Musekeja road, it will join the Trans-Balkanic not far from Pekini, at a suitable spot between Fieri and Berat.

The recent blockading on the Transandine line (Buenos Aires to Valparaiso), on account of snowstorms blocking the Uspallata Pass, has again brought forward suggestions for a new transcontinental line in South America. The most immediately practical idea is that necessitating the construction of only 175 miles of railway, and even though this includes the crossing of the Andes, the height to be negotiated does not exceed 6,000 ft. By this means the line would be free from danger of blockades through snow blizzards, and the expense and difficulties connected with railways constructed to climb higher altitudes would be obviated. The transcontinental line in existence at present in South America is the Buenos Aires-Valparaiso railway, about 1,030 miles in length, crossing the Andes at a height of 10,470 ft., the Andean section of this line being of a gage different from

that of the railways of Argentina and Chile, which complete the link on the other side, necessitating three handlings of freight on each through journey. Completion of the new route would mean the creation of a second sea-to-sea railroad over an all broad gage line (5 ft. 6 in.), traversing ascents of such easy grade that no "rack" sections would be necessary.

The Imperial Government Railways of Japan intend to build a tunnel under the Shimonoseki strait, the real work to commenec in 1921. Engineers and workmen will be sent to America and Europe to make a study of what has been achieved in these countries in the way of tunnel engineering. The line is to be seven miles long, one mile of which will be entirely under the sea. The approximate cost of the undertaking will be about $10,000,000, and the work is expected to be completed in 1928.

C. H. Merz, of Messrs. Merz and McClellan, has presented to the government a report on the problem of electrifying the railways of the Union of South Africa, which deals with four sections of lines—the main line from Cape Town to Touws River with suburban lines in the peninsula; the Natal main line from Durban to Glencoe, and the Glencoe-Vryheid East branch; the Witbank-Germiston-Randfontein line; and the Delagoa Bay line between Witbank and Komati Poort. The direct-current system is regarded as most suitable for South African requirements. Though the narrowness of the gage to some extent restricts the use of high-voltage motors, supply to trains at an average of 3,000 volts is pronounced practicable and desirable. The overhead system is recommended and regenerative working will be adopted.

EXPORTS DURING OCTOBER, 1919

The exports of steel rails during October totaled 43,730 tons, valued at $2,479,648; of spikes, 2,899,162 lb., valued at $130,941, and of switches, frogs, splice bars, etc., valued at $533,246. With the exception of the last figure these totals were not as great as those for September. The October figures in detail as compiled by the Division of Statistics of the Bureau of Foreign and Domestic Commerce were as follows:

	Spike		Steel Rails		Switches, Frogs, Splice Bars, etc.
Countries	Pounds	Dollars	Tons	Dollars	Dollars
Belgium	.....	.....	92	5,740	.....
Denmark	.....	.....	.....	.....	143
France	.....	.....	1,726	111,215	38,019
Italy	.....	.....	1,343	78,064	640
Norway	7,000	246	31	2,300	680
Portugal	.....	.....	384	26,216	185
Spain	.....	.....	30	1,300	.....
England	.....	.....	838	48,604	4,635
Canada	4,719	228	543	32,226	13,257
Costa Rica	1,200	68	.....	.....	252
Guatemala	11,000	409	.....	.....	1,200
Honduras	74,800	2,798	597	31,704	5,377
Panama	.....	.....	89	3,724	121
Salvador	1,200	63	313	14,238	1,257
Mexico	65,373	2,418	642	26,995	16,558
Newfoundland and Labrador	10	1	.....	.....	.....
Jamaica	.....	.....	12	795	510
Trinidad and Tobago	.....	.....	6	418	44
Other British West Indies	1,600	80	.....	.....	.....
Cuba	1,202,760	44,711	6,454	348,692	70,947
French West Indies	600	28	194	10,066	817
Haiti	.....	.....	.....	.....	250
Dominican Republic	11,300	737	.....	.....	8,650
Argentina	.....	.....	10	940	.....
Brazil	248,393	10,211	2,700	131,035	133,283
Chile	619,095	42,928	1,916	115,502	5,731
Colombia	6,720	336	.....	.....	1,602
British Guiana	1,400	59	.....	.....	.....
Paraguay	44,800	2,000	400	20,839	1,900
Peru	89,800	4,188	419	23,861	19,351
Venezuela	1,000	52	78	3,867	234
China	.....	.....	661	45,064	.....
Chosen	4,000	226	.....	.....	.....
British India	.....	.....	1,149	76,439	3,289
Straits Settlements	.....	.....	154	10,433	418
Dutch East Indies	82,174	5,540	3,221	160,287	91,557
Hongkong	.....	.....	225	18,195	4,130
Japan	197,138	6,202	13,505	766,542	59,823
Australia	.....	.....	.....	.....	3,038
Other British Oceania	480	24	.....	.....	.....
Philippine Islands	222,600	7,389	2,845	153,068	4,074
Belgian Congo	.....	.....	.....	.....	220
British South Africa	.....	.....	3,153	211,279	41,054
Total	2,899,162	130,941	43,730	2,479,648	533,246

SUPPLY TRADE NEWS

GENERAL

The Kilby Frog & Switch Company of Birmingham, Ala., will build a $30,000 plant addition, with 11,250 sq. ft. of floor space.

The Chicago Pneumatic Tool Company, Chicago, removed its Birmingham office from 801 Brown Marx building to 1925 Fifth avenue, north, on October 1.

The Reading Iron Company, Reading, Pa., has opened new district sales offices in Pittsburgh and Chicago, in charge of F. M. English and R. A. Griffin, respectively.

The Plant of E. A. Kinsey Company, Cincinnati, Ohio, manufacturers of railway and contractors' supplies, was damaged by fire on November 21 to the estimated extent of $100,000.

The Kalamazoo Railway Supply Company, Kalamazoo, Mich., has increased its capital stock from $150,000 to $300,000 and plans the erection of an addition to its plant 100 ft. by 310 ft. to cost $10,000.

Fairbanks, Morse & Co., Chicago, have purchased a lot 300 ft. by 150 ft. in the central manufacturing district of that city on which to erect a new warehouse to cost $15,000. It will be of brick and concrete, three stories and a basement.

The Sherwin-Williams Company, Cleveland, Ohio, is contemplating the erection of a factory at Kansas City, Mo., to cost $500,000. The first unit will be equipped for the manufacture of paint and will be followed by the construction of a varnish factory.

Joseph E. Nelson & Sons, Chicago, contracting engineers, have moved their office from 118 N. La Salle street to 3240 S. Michigan boulevard. This firm has also opened a branch office in the Kansas City Life building, Kansas City, Mo., under the direction of **D. O. Dugger.**

The International Railway Supply Company, New York, announces that it has incorporated with the International Railway Supply Company of Cuba, **Otis R. Hale**, former locomotive superintendent of the United Railways of Havana, as manager. The office of the company in Havana is at Edificio Abreu, room 501, corner Mercaderes y O'Reilly.

The Bucyrus Company, South Milwaukee, Wis., has moved its southern sales office from New Orleans, La., to Jefferson County Bank building, Birmingham, Ala. **C. N. Ballentine** will remain as southern sales manager and will be assisted by **E. J. Wilkie**, who for many years has been connected with the sales department at South Milwaukee.

The Chicago Pneumatic Tool Company reports for October an influx of orders in excess of the record of any previous month since the armistice. The same is true of the company's English and German subsidiaries. Following this country's entrance into the war the German subsidiary was seized by the German government and has been run under "compulsory administration," but that administration has now been abolished and the management is being transferred back to the company through the courts of commerce.

The Standard Asphalt & Refining Company, with general offices at Chicago, has made arrangements with the Insulite Products Company, Inc., Railway Exchange Building, Portland, Ore., to handle its products. The Insulite Products Company is a new company which has been organized recently under the management of **F. B. Gilman**, formerly of the F. B. Gilman & Co. Branch offices are to be opened in Spokane, Wash.; Tacoma; Seattle; San Francisco, Cal., and Los Angeles.

Fairbanks, Morse & Company are planning to erect a $1,500,000 foundry at Beloit, Wis., which will be 900 ft. long, 550 ft. wide and will contain 495,000 sq. ft. of floor space. Work will be started next spring. The foundry,

when completed, will consist of one large building covering 11 acres of ground and including facilities for the storage of flasks, iron, sand, etc. The capacity of the new plant will be approximately 350 to 400 tons of gray iron daily.

PERSONAL

M. M. Drake has been appointed manager of the railway supply division of the Pierce Company of Kansas City, with headquarters in Chicago.

Richard J. McComb has been appointed assistant to the president of the Q. & C. Company, with headquarters at Chicago. Mr. McComb was born at New Castle, Pa., on February 4, 1884, and graduated from the Pennsylvania State College in 1905. He entered railway service in June, 1905, with the Wheeling & Lake Erie as a rodman and was promoted to assistant engineer in August, 1908. From July, 1911, to August, 1912, he served as roadmaster and from the latter date until June, 1917, served consecutively as division engineer, engineer of maintenance of way and superintendent of tracks. Mr. McComb was promoted to superintendent of construction in June, 1917, which position he held until September, 1918, when he left the railroad to go with the Q. & C. Company.

Richard J. McComb

W. D. Horton, district sales manager of the Patton Paint Company, has resigned to accept a position with the Murphy Varnish Company, Western Railway Department, with headquarters at Chicago, effective December 1. Mr. Horton was born in Brooklyn, N. Y., on December 3, 1880, and received his education in the public schools of that city. On June 1, 1908 (at the time of the consolidation of the Railway Age and the Railroad Gazette) he joined its staff and from 1908 to 1914 acted as traveling subscription representative, being appointed circulation manager on April 1, 1914. Mr. Horton spent several years previous to 1908, selling various stationary engines, boilers, wood-working and other machinery, in which work he traveled extensively throughout the United States, Canada, Mexico, Cuba, the West Indies, and in South and Central America.

W. D. Horton

A. C. Allshul, in charge of the Milwaukee, Wis., office of Joseph T. Ryerson & Son, Chicago, has been appointed branch manager of its new warehouse plant at Buffalo, N. Y., this company having recently bought the warehouse plant, stock and good will of the Ferguson Steel & Iron Company, Buffalo. The property covered by the purchase at Buffalo includes a main building of about 100,000 sq. ft., together with a large crane-served yard, office building, garage and storehouse. Plans are being made to carry out extensive improvements and for the enlargement of the property this coming winter. The Ryerson Company now has plans for warehouse service at Chicago, New York, Detroit, St. Louis and Buffalo.

R. H. Brown, Jr., of the St. Louis, Mo., office of the Ingersoll-Rand Company, New York, has been appointed manager of the new offices of the company in the Sam Houston Life building at Dallas, Tex.

John Kopf, formerly associated with the Bureau of Air Craft Production, with headquarters at Dayton, Ohio, has been appointed manager of the engineering department of the Duff Manufacturing Co., Pittsburgh, Pa., with offices in that city.

A. W. Swan of the sales department of the Canadian Ingersoll-Rand Company, Sherbrooke, Que., with headquarters in that city, has been appointed assistant secretary of the Engineering Institute of Canada, with offices at Montreal, Quebec.

W. H. Scales, chief designing engineer of the Lackawanna Bridge Company, with headquarters at Buffalo, N. Y., has resigned to become associated with **W. E. Russ**, architect, of Indianapolis, Ind., as chief of engineering and construction.

TRADE PUBLICATIONS

Blaw Single Line Buckets.—The Blaw-Knox Company, Pittsburgh, Pa., has recently issued a folder devoted to its single line buckets. It contains considerable information relative to its uses and includes photographs of installations and tables of capacities, dimensions, clearances, etc.

Locomotive Cranes.—An illustrated folder has recently been issued by the Erie Engine Company, Erie, Pa., which contains short descriptions and illustrations of the various applications of the type-B Erie locomotive cranes to dredging, trenching, loading materials, hoisting, etc. Tables and diagrams of the dimensions of this equipment and the capacities, weights, etc., are also given.

Continuous Rail Crossing Frogs.—An illustrated pamphlet, 16 pages, known as "Installation Book A," has recently been issued by the Eymon Crossing Company, Marion, Ohio, describing the continuous rail crossing frogs made by this company. The general construction and operating features of these crossings are shown by means of photographs of installations on various railroads of the country.

Erie Shovels.—The Ball Engine Company, Erie, Pa., has issued a large size six-page folder, 12 illustrations, as Bulletin S-36, devoted to the use of Erie shovels in handling rock. The illustrations show actual conditions under which these shovels have worked and the class of material handled. Data on amount moved, time and cost, etc., is furnished through the medium of letters from owners who are using the Erie shovel in rock work.

Link-Belt Elevators and Conveyors.—Book No. 375, 108 pages, illustrated, has just been issued by the Link-Belt Company, Chicago, Ill., devoted to the labor-saving elevators and conveyors manufactured by this company. The illustrations show the different types and the various ways in which they are utilized in actual practice in handling bags, barrels, boxes, lumber, miscellaneous freight, machinery, etc.

Link-Belt Electric Hoists.—The Link-Belt Company, Chicago, Ill., has recently issued a new catalogue known as Book No. 380, 100 pages, illustrated, which covers electric hoists, mono-rail trackwork, electric telphers, overhead traveling cranes and revolving locomotive cranes. Considerable data and information relative to the different types manufactured, their dimensions and capacities has been given in connection with the illustrations and drawings.

Welding and Cutting Equipment.—The Carbo-Hydrogen Company of America, Pittsburgh, Pa., has issued nine bulletins bound in a folder, describing cutting and welding torches and tips, regulators and a portable cutting outfit mounted on a truck. All of the parts for carbo apparatus are catalogued in one of the bulletins and another contains directions for operating carbo cutting torches, bringing out some points that should be carefully observed when operating any cutting torch.